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Draft Environmental Impact Statement Malakoff Electric Generating Station and Trinity Mine, Henderson and Anderson Counties, Texas

(U.S.) Environmental Protection Agency
Dallas, TX

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EPA is considering the issuance of new source National Pollutant Discharge Elimination System (NPDES) permits to Houston Lighting & Power Co. for wastewater discharges from the Malakoff Electric Generating Station and to the North American coal coporation (NACCO) for wastewater discharges from the Trinity Mine.

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1201 Elm Street
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Water

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Environmental Impact Statement

Draft

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

FEB 16 1983

TO ALL INTERESTED AGENCIES, OFFICIALS, GROUPS, AND INDIVIDUALS:

To comply with the provisions of the National Environmental Policy Act (NEPA) of 1969, the Environmental Protection Agency (EPA) has prepared this Draft Environmental Impact Statement (EIS) on the proposed issuance of new source National Pollutant Discharge Elimination System (NPDES) permits for wastewater discharges from the Trinity Mine in Henderson and Anderson Counties, Texas and the Malakoff Electric Generating Station in Henderson County, Texas.

EPA will hold a Public Hearing on the Draft EIS at the Crossroads School Auditorium, Intersection State Highways 90 and 59, Crossroads, Texas at 7:30 p.m. on April 5, 1983.

Written comments on the Draft EIS should be submitted to Mr. Clinton B. Spotts, Regional EIS Coordinator, Region 6, 1201 Elm Street, Dallas, Texas, 75270 by April 18, 1983. Comments on the Draft will be incorporated into the Final EIS. The Final EIS will be sent only to agencies and interested parties who request a copy or make comments on the Draft.

If you need additional information, please contact Mr. Clinton B. Spotts at (214) 767-2716 or FTS 729-2716.

Sincerely yours,

Frances E. Phillips
Dick Whittington, P.E.
Regional Administrator

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

DRAFT ENVIRONMENTAL IMPACT STATEMENT
MALAKOFF ELECTRIC GENERATING STATION AND TRINITY MINE
HENDERSON AND ANDERSON COUNTIES, TEXAS

RESPONSIBLE AGENCY: U.S. Environmental Protection Agency Region 6 (EPA).

COOPERATING AGENCY: USDA Soil Conservation Service; USDOI Fish and Wildlife Service; U.S. Army Corps of Engineers; Texas Historical Commission; USDOI Office of Surface Mining; Texas Railroad Commission; Texas Air Control Board; Texas State Department of Highways and Public Transportation; Texas Parks and Wildlife Department.

PROPOSED ACTION: Issuance of new source National Pollutant Discharge Elimination System (NPDES) permits to Houston Lighting and Power Company (HL&P) and North American Coal Corporation (NACCO) for discharge of wastewater from the Malakoff Electric Generating Station and the Trinity Mine.

CONTACT FOR FURTHER INFORMATION: Clinton B. Spotts, Regional EIS Coordinator, U.S. Environmental Protection Agency, 1201 Elm Street, Dallas, Texas 75270, (214) 767-2716 or FTS 729-2716.

ABSTRACT: EPA is considering the issuance of NPDES permits to HL&P and NACCO. Wastewaters will be conveyed by various tributaries to the Trinity River. Plant water will be obtained from the Upper Neches Municipal River Water Authority and will be transported via a 45 mile pipeline to a storage pond at the plant site. Bottom ash, fly ash, and other solid waste will be disposed of on-site. NACCO proposes to mine approximately 600 acres per year over the next 35 years. The company's proposed mining operations will include clearing, removing overburden, mining lignite, replacing overburden either randomly or segregating selected layers, and reclaiming surface lands to either pre-mining conditions or to predominately pastureland. 130 million tons of gravel will either be mined and marketed or mixed into the overburden. Earth will be disturbed by mining to a depth of 175 feet and by construction of ponds, diversions, dikes, haul roads and pipeline relocations. Environmental changes include loss of 12,796 acres of prime farmland, change in the characteristics of the remaining topsoil, disturbance of aquifers above the lignite resulting in reduced horizontal permeability and increased vertical permeability, lowering of the ground-water table, and potential degradation of ground water quality. If reclamation is to pastureland rather than the current land use there will be a loss of wildlife habitat resulting in reduced populations and

species diversity. Also, the converted area will require a high level of management. If gravel is not mined, the resource will not be recoverable in the future. If randomly mixed overburden is used there is a potential for the development of acid conditions in the soil which would have to be remedied by NACCO before the area could be released from bond. There could be a 10% reduction in soil productivity over the entire mine area. Small acreages of wetlands may be destroyed. Potential exists for secondary water quality impacts dependent on the success of land reclamation, revegetation and management. Air and water quality control measures are proposed to reduce fugitive dust, SO_2, NOx, TSP emissions, stormwater runoff, erosion and sedimentation. Surface and sub-surface water monitoring programs also are planned to report flow and water quality conditions on-site. Area health, educational, governmental, housing and commercial service needs will increase due to induced population increases.

COMMENTS ON DRAFT EIS DUE: April 18, 1983.

Responsible Official

Frances E. Phillips
Dick Whittington, P.E.
Regional Administrator

1.0 SUMMARY

1.1 SUMMARY DESCRIPTION OF AGENCY ACTION

The National Environmental Policy Act of 1969 (NEPA) requires that all Federal agencies prepare environmental impact statements on major Federal actions significantly affecting the quality of the human environment. Furthermore, Section 511(c)(1) of the Federal Water Pollution Control Act (FWPCA, or P. L. 92-500) as amended by the Clean Water Act of 1977 (CWA, or P. L.-95-217) mandates that the requirements of NEPA apply to the issuance of a permit, under Section 402 of FWPCA, for discharging any pollutant by a "New Source" as defined in Section 306 of FWPCA. The Environmental Protection Agency (EPA) has determined that the Malakoff Electric Generating Station proposed by Houston Lighting & Power Company (HL&P) and the Trinity Mine proposed by The North American Coal Corporation and Getty Oil Company (NACCO/Getty) constitute New Sources and, therefore, the issuance of a New Source National Pollutant Discharge Elimination System (NPDES) permit is a major Federal action significantly affecting the quality of the human environment. Consequently, this Environmental Impact Statement (EIS) is prepared to assess the impacts of EPA's New Source NPDES permit action.

1.2 PURPOSE AND NEED

Houston Lighting & Power Company provides electricity to 158 cities and towns in a 12,960-km^2 (5,000-mi^2) area on the Houston-Gulf Coast that boasts a population of nearly three million people. This service area represents only about two percent of Texas' land area but it contains nearly one quarter of the state's population and consumes about 35 percent of the state's electricity.

The population in HL&P's service area is expected to increase in population by nearly 1,000,000 residents by 1991. Attendant with the population increase, and commercial and industrial expansion, total peak demand for the HL&P system is projected to rise from 10,540 MW in 1982 to 14,100 MW in 1991. To meet the anticipated growth in demand, HL&P will require new generating capacity including the Malakoff EGS.

Through the end of 1977, HL&P relied almost exclusively on natural gas as a source of fuel. In the late 1960s, HL&P recognized that it could no longer rely on natural gas as a fuel source for its new generating units. In the early 1970s, HL&P embarked on a fuel diversification plan which specified that all additions to base load generating capacity be powered by nuclear fuel or coal. Because of the potential for gas curtailments, there was an additional program to convert substantial gas-fired boiler capacity to oil.

HL&P selected lignite as the fuel source for these two units based on its desire for fuel diversification, the mandates of the Powerplant and Industrial Fuel Use Act, the long lead times required for nuclear units, the high transportation cost associated with western coal, and the availability and relatively low cost of lignite.

1.3 ALTERNATIVES

1.3.1 Project Alternatives

1.3.1.1 Alternatives Evaluated by HL&P

HL&P considered several alternatives that would not require creation of new generating capacity. These included: 1) energy conservation; 2) purchasing power from neighboring utilities; 3) reactivation or upgrading of older units; and 4) baseload operation of existing peaking facilities. None of these options alleviated the need for new generation.

HL&P then evaluated alternative energy sources which included: 1) geothermal; 2) solar; 3) wind; 4) coal and petroleum gasification; 5) natural gas; 6) western coal; 7) nuclear; 8) biomass; and 9) lignite. Based on a thorough evaluation of alternative fuels, HL&P selected lignite.

Next, HL&P evaluated several lignite reserves in the State of Texas. This evaluation was primarily an economic comparsion which also considered mine plan development and availability of a suitable power plant site. Based on a comparison of all resource areas evaluated, HL&P selected the Trinity Mine as the fuel source for its required new generation.

Once the fuel source was identified, the site selection process was initiated to locate a prime site having high environmental and economic acceptability for a nominal two-unit lignite-fired steam-electric generating station.

A candidate area was selected first. Within the candidate area, five potential sites were located and evaluated. The proposed site of the Malakoff EGS was ranked first in the overall evaluation.

HL&P also considered alternative water sources to supply cooling water needed for the Malakoff EGS. Of the 129 possible sources or combinations of sources identified, all but four were eliminated by basic physical, permitting or economic considerations.

From an economic standpoint, due in part to its proximity, Cedar Creek Reservoir was the prime candidate. However, after careful consideration, use of Cedar Creek Reservoir as the source of cooling water was eliminated as a favorable option, due to the inability of Cedar Creek Reservoir to be a reliable source of water for the Malakoff EGS.

The next alternative considered was water from the Neches River - Lake Palestine. Based upon several engineering and economic evaluations, the Upper Neches River Municipal Water Authority system was selected as an economic and reliable source of water for the Malakoff EGS.

HL&P also considered various design alternatives for the generating station including: 1) cooling system alternatives; 2) biological control system alternatives; 3) plant discharge system alternatives; 4) liquid waste management system alternatives; 5) solid waste management alternatives; 6) sanitary waste system alternatives; 7) air quality control system alternatives; and 8) transmission facility alternatives.

1.3.1.2 Alternatives Evaluated by NACCO/Getty

Alternatives considered by NACCO included: 1) mining method alternatives; 2) overburden handling alternatives; 3) resource recovery and transportation alternatives; 4) reclamation alternatives; 5) post-mining land use alternatives; and 6) sand and gravel handling alternatives.

1.3.1.3 Alternatives Available to EPA

Alternatives available to EPA include: 1) issuance of NPDES permits to the applicants (HL&P and NACCO/Getty); 2) issuance of NPDES permits with certain conditions; or 3) deny the issuance of NPDES permits.

1.3.1.4 Alternatives Available to Other Permitting Agencies

The alternatives available to other permitting agencies are essentially those available to EPA: 1) issuance of a permit; 2) issuance of a permit with certain conditions; or 3) deny issuance of the permit.

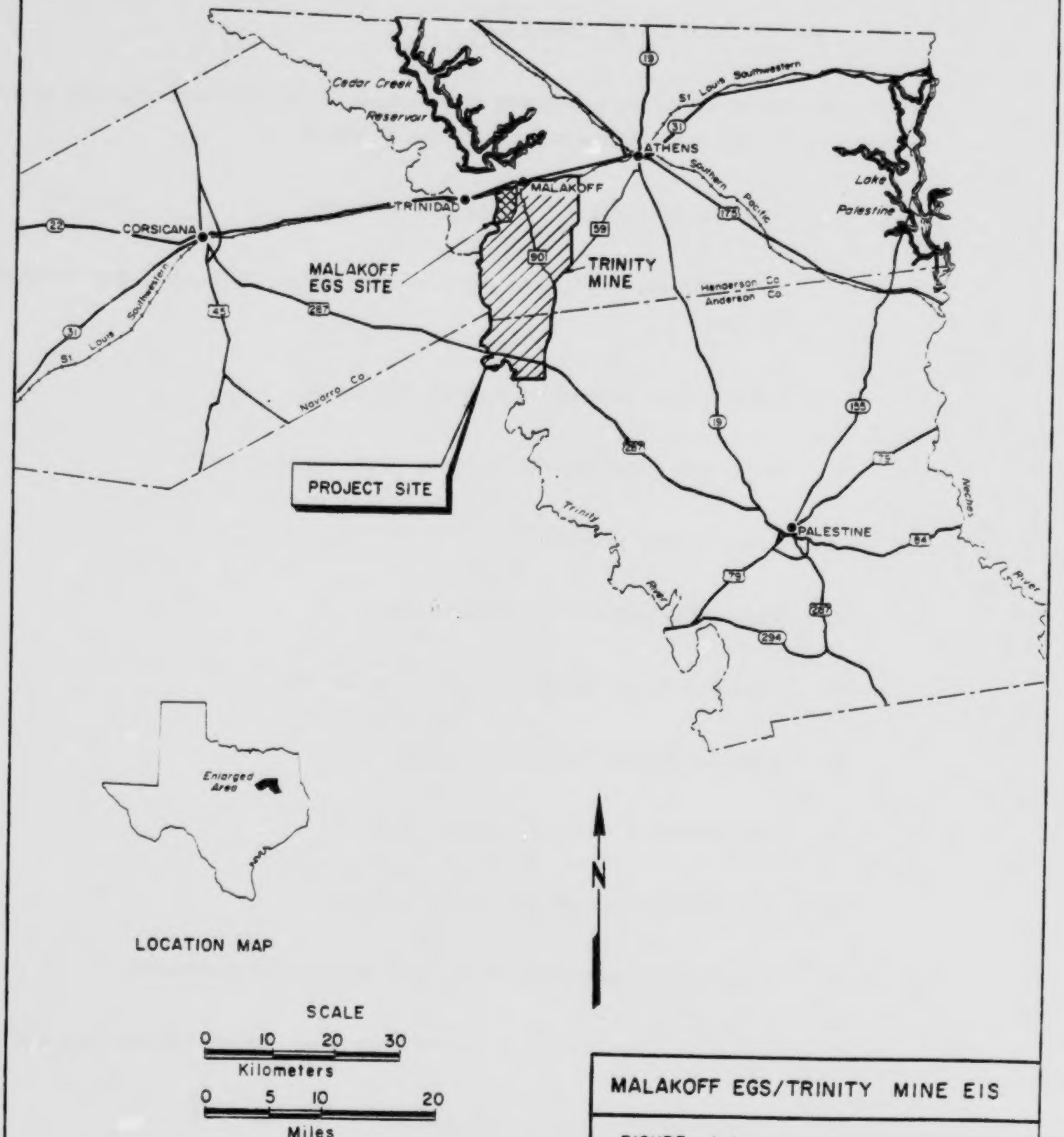
1.4 PROPOSED PROJECT

The project area, which includes the generating station and mine site, is located southwest of the City of Malakoff in Henderson County, Texas (Fig. 1-1). The project area includes approximately 23,308 ha (57,600 ac) consisting of approximately 1,394 ha (3,400 ac) for the Malakoff EGS site and approximately 22,222 ha (54,200 ac) for the Trinity Mine. This area is bounded on the north by Highway 31, on the west by the Trinity River, on the east by the towns of Cross Roads and Cayuga, and extends south approximately 2.8 km (1.75 mi) south of and parallel to Highway 287.

A 72-km (45-mi) long pipeline will transport cooling water from the Neches River to the Malakoff EGS site. Two 345 kv transmission lines will exit the switchyard and proceed north approximately 3.7 km (2.3 mi) to the Trinidad-Forest Grove transmission facilities. The electricity produced at the Malakoff EGS will flow through the ERCOT system to the HL&P service area approximately 320 km (200 mi) to the south. The main plant area will occupy approximately 164 ha (400 ac). An additional 215 ha (525 ac) will be required for a materials handling area. Approximately 58 ha (141 ac) will contain other ancillary facilities.

The mine, which is located just south of the generating station, will provide lignite to fuel the generating station. Approximately 251 ha (611 ac) per year will be mined for the life of the mine (approximately 35 years). NACCO/Getty is currently evaluating various overburden removal techniques, including the use of bucket wheel excavators and draglines.

Mining is presently planned to begin in the northwest corner of the mine area (in an area of shallow overburden and nearest the generating station). Mining will gradually proceed toward the east and south. Although only approximately 8,774 ha (21,400 ac) will be mined to meet the fuel requirements of the Malakoff EGS, an additional 6,847 ha (16,700 ac) are available for lignite mining. If a market becomes available in the future, NACCO intends to mine the additional acreage.


Cedar Creek Reservoir
St Louis Southwestern
19
31
ATHENS
Southern Pacific
175
Lake Palestine
MALAKOFF
TRINIDAD
CORSICANA
22
59
90
MALAKOFF EGS SITE
TRINITY MINE
Henderson Co
Anderson Co
45
287
31
St Louis Southwestern
Navarro Co
PROJECT SITE
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287
155
79
Trinity River
Neches River
PALESTINE
84
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287
294
Enlarged Area
LOCATION MAP
N
SCALE
0 10 20 30
Kilometers
0 5 10 20
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 1-1

GENERAL LOCATION MAP

1.5 ENVIRONMENTAL CONSEQUENCES

Environmental consequences of project alternatives and the no action alternative are summarized in Table 1-1.

1.6 MAJOR ISSUES AND CONCERNS

The major issues and concerns expressed by Federal, State and local agencies; organizations; and individuals during the scoping process included:

1) Potential for contamination of ground water;

2) Successful reclamation in terms of surface soil suitability and revegetation efforts;

3) Impacts to surface-water quantity and quality;

4) Impacts to and protection of wetlands and riparian areas;

5) Loss of wildlife habitat;

6) Postmining land use and reclamation;

7) Consideration of impacts to cultural resources;

8) Land use changes due to reclamation;

9) Socioeconomic impacts to communities;

10) The effects of the project on area schools;

11) Consideration of transportation systems and traffic increases;

12) Effects on local air quality due to stack emissions and fugitive dust; and

13) Effects on sound quality due to project activities.

TABLE 1-1

ENVIRONMENTAL CONSEQUENCES

Factor	Project Alternatives	No Action Alternative
Geology and Topography	Long-term disruption of geologic strata; no long-term adverse impacts to topography. Short-term, adverse impacts to oil and gas production. Potential loss of sand and gravel in portions of the mine. No cumulative effects.	No adverse impacts to geologic structure or topography with the exception of sand and gravel mining in the alluvial area.
Soils	Erosion will increase during construction and mining prior to re-establishment of vegetation. Final impact will be determined by final overburden handling technique selected. With the randomly mixed overburden or the segregated weathered zone as a topsoil substitute, the following impacts are expected: 1) short-term surface crusting; 2) short-term absence of microbial organisms; and 3) short-term absence of organic material. Except for soils in Group B (see Table 5-3) which represent approximately 10 percent of the mine site, data indicate no initial liming requirement for either of the overburden soil substitute alternatives. The potential for the occurrence of highly acidic surface areas, "hot spots," is highest with the randomly mixed alternative. These areas must be treated with lime or buried to a depth of 4 ft. Topsoiling (A horizon) will return the original surface soils over a subsoil of overburden material. This alternative will approximate existing soil surface layer on the mine area. Long-term, adverse impact of loss of prime farmland soil characteristics. Potential loss of 10 percent productivity of all soils.	Minimal erosion from agriculture and impact due to sand and gravel mining operations in alluvial area.
Ground Water	Dewatering will cause short-term, adverse impacts to shallow aquifer but impacts will be largely confined to within project boundary; no significant cumulative effects. Long-term, adverse anticipated reduction in horizontal permeability and transmissivity causing a reduction in lateral flow of ground water through cast overburden material, when compared to aquiferous strata above the lignite which existed prior to mining. Ground-water withdrawals of 100 to 200 gpm during construction of the power plant will potentially produce a 25- to 50-ft drawdown at the City of Malakoff's water wells. Ground-water withdrawal of 50 gpm during operation will potentially produce a 12.5-ft drawdown at the City of Malakoff's wells.	Continued impact to alluvial aquifer from sand and gravel operations.
Surface Water	During mining, a slight increase in runoff volumes to the Trinity River is projected. Peak flows after mining will be decreased slightly; runoff volume not affected significantly; no long-term or short-term adverse impacts to water quality of streams; no significant cumulative effects.	None
Wetlands	About 619 ha (1,510 ac) of wetlands may be adversely affected; adverse cumulative impacts by reduction of wetland acreage.	Minor adverse cumulative impacts by reduction of wetland acreage.

TABLE 1-1 (Cont'd)

Factor	Project Alternatives	No Action Alternative
Terrestrial Biology	Short-term adverse impacts related to removal of upland and bottomland forest acreage with concomitant reduction of wildlife habitat. Long-term impact will depend on postmining land use alternative selected. Return to existing land use will result in a short-term increase in diversity after the period of vegetation establishment and until climax community is established. The time required for the grassland communities to be reestablished will be relatively short (2 to 5 years). For forest communities, the climax will take 35 years or longer. After the establishment period, biological productivity will approximate existing conditions. Conversion to 100 percent improved pasture will represent a significant, adverse impact to wildlife. Adverse cumulative impacts associated with removal of wildlife habitat.	Minor cumulative adverse impacts by reduction of upland forest acreage due to landowner preferences.
Aquatic Biology	Minor short-term adverse impacts associated with construction and operation activities.	None
Threatened or Endangered Species	Disruption of potential alligator and bald eagle habitat in some areas of the mine.	Minor cumulative adverse impacts by reduction of bottomland forest acreage.
Archaeological and Historical Resources	Adverse impacts to sites will be mitigated by complying with the terms of a Memorandum of Agreement to be signed by the Advisory Council, the State Historic Preservation Officer, EPA and the Companies.	Adverse impacts caused by local collectors, and further natural weathering.
Air Quality	No adverse impacts to air quality from stack and fugitive emissions.	No impacts expected.
Sound Quality	Slight increase in ambient sound levels offsite; no significant impact expected.	No impacts expected.
Land Use and Recreation	Long-term impacts will result from the reduction in the amount of forested land on the site and an increase in the amount of pasture. No impacts will occur to recreation.	Long-term decreases in upland and bottomland forest and increases in pasture.
Population	Short-term population increase of 5,159 people peaking in 1987. Long-term population increase of 2,952 people during operation.	Long-term increases due to predicted future growth.
Economy	Both short-term and long-term beneficial impacts will result directly from the project (wages, land purchases and capital expenditures) and secondary beneficial impacts also will result.	Minor long-term changes possible with future development.
Housing	Adverse short-term impacts are expected, stabilizing during operation.	Minor long-term changes possible with predicted future growth.

TABLE I-1 (Concluded)

Factor	Project Alternatives	No Action Alternative
Water and Wastewater Systems	The impact of project-related in-migrants will vary among project area communities. In Athens, current user demands on water and wastewater systems equal or exceed current design capacity. The City is seeking Federal grant assistance for wastewater system improvements. In Corsicana, both water and wastewater systems appear to have ample excess capacity to handle more than the predicted peak in-migrating population. The potable water system of the City of Malakoff has sufficient excess treatment capacity to accommodate anticipated in-migrating population, but will require storage capacity in excess of its current capacity. The Malakoff wastewater system is now operating at or near design capacity and will require expansion to accommodate growth. Trinidad has sufficient excess treatment capacity for both water and wastewater systems, but will have to expand potable water storage capacity. Palestine will also need to add potable water storage capacity; the City has received approval for a wastewater construction grant to make system improvements required by current user demand.	In Athens, current user demands on water and wastewater systems equal or exceed current design capacity. Grant assistance has been requested for wastewater improvements. Corsicana water and wastewater systems have ample capacity for growth. Malakoff has sufficient excess treatment capacity for potable water but requires additional storage capacity. The Malakoff wastewater treatment plant is now operating at or near design capacity. Trinidad has sufficient excess treatment capacity for both water and wastewater. Palestine is deficient in elevated storage for potable water. Palestine's wastewater treatment facilities require expansion to meet current user demands.
Police and Fire Protection	Project-related in-migrants to Corsicana, Athens and Malakoff will require two additional officers in each city, while Trinidad and Palestine will each require one officer to maintain current population to service ratios. A population influx of 5,159 persons represents a need for six additional firefighters in the project area. Athens, Corsicana, Malakoff and Trinidad may each receive sufficient new residents to warrant one or two additional firefighters.	Police and fire protection are adequate for existing populations.
Medical Services	The influx of 5,159 persons represents a need for three to four additional doctors, according to HEW service recommendations. With the greater proportion of in-migrants likely to move into Athens, Corsicana and Malakoff, an additional doctor would be needed in each of these cities. However, no significant, adverse impact is expected at existing service levels over the temporary peak population period.	Current levels can accommodate a moderate increase in demand.
Education	In order to maintain current teacher-student ratios, an additional 11 to 13 teachers would be needed in the three-county area, three each in the Athens, Corsicana and Malakoff school districts, two in the Trinidad school district and one in the Palestine school district.	Minor additional increases in staffing levels possible to meet anticipated future growth.
Transportation	No short-term or long-term adverse impacts to transportation systems will result because of minor traffic increases.	Minor long-term changes possible with predicted future growth.
Community Finances	Short-term and long-term beneficial impacts to municipal, county and state finances associated with tax revenues.	Minor long-term changes possible with future development.

These issues and concerns, as well as others, are addressed in detail in the appropriate sections of the EIS.

MALAKOFF ELECTRIC GENERATING STATION/TRINITY MINE EIS
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3.0 INTRODUCTION, PURPOSE AND NEED

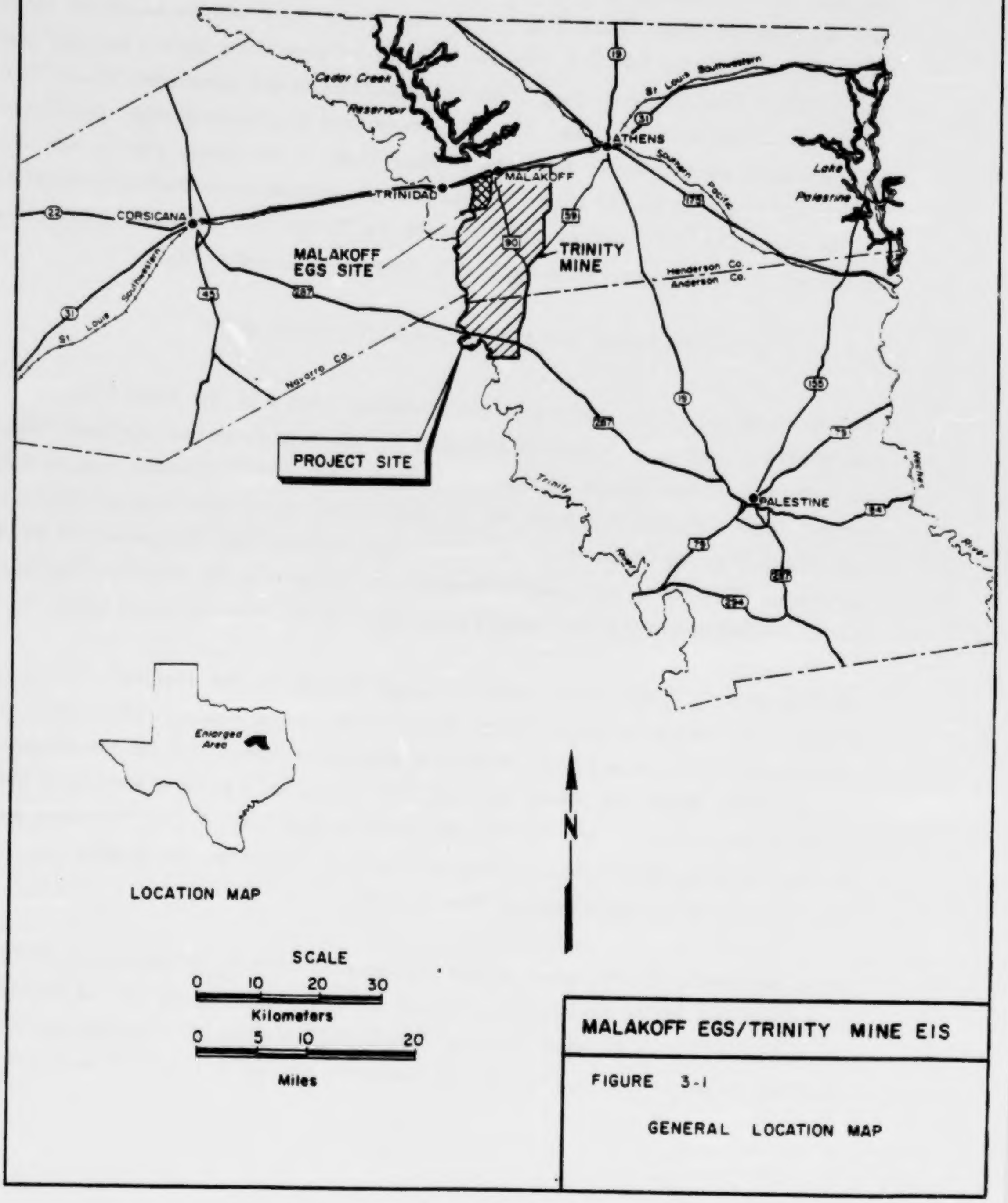
This Environmental Impact Statement (EIS) is prepared to assess the effects of a proposed surface lignite mine and a mine-mouth electric generating station located in Henderson and Anderson counties, Texas (Fig. 3-1). The Trinity Mine will be owned by NACCO/ Getty and operated by NACCO. Houston Lighting & Power Company will own and operate the Malakoff Electric Generating Station (Malakoff EGS) and associated 3.7-km (2.3-mi) long electric transmission lines. The 72.5-km (45-mi) long makeup water pipeline which will transport cooling water from the Neches River to the power station site will be owned and operated by the Upper Neches River Municipal Water Authority (UNRMWA). Utility Fuels, Inc. (UFI) will own and operate the 2.7-km (1.7-mi) long lignite conveyor which will transport lignite from the Trinity Mine to the Malakoff EGS.

3.1 EPA'S RESPONSIBILITY AND LEGISLATIVE AUTHORITY

Before discharge of any pollutant into navigable waters of the United States from a designated source in an industrial category for which performance standards have been promulgated, a new source National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Environmental Protection Agency (EPA). Section 511(c)(1) of the Clean Water Act (CWA) also requires that the issuance of an NPDES permit by EPA for a new source discharge be subject to the National Environmental Policy Act (NEPA), which may require preparation of an EIS on the new source.

On February 11, 1982, EPA issued a Legal Notice in the Malakoff News, and on February 14, 1982, EPA issued a Legal Notice in the Athens Review. The purpose of these notices was to announce EPA's intention to prepare a "tiered" EIS for the Malakoff EGS and the Trinity Mine. On March 18, 1982, EPA conducted a Scoping Meeting in Malakoff, Texas to solicit public input for the generating station EIS. A Responsiveness Summary for that meeting, which discussed the comments of the public, was prepared by EPA and distributed to interested parties on May 12, 1982.

After the March 18, 1982 meeting, based on requests made by the applicants, EPA decided to prepare one EIS to discuss both the mine and the generating station. A second Notice was published in the Malakoff News on May 6, 1982 announcing a second public Scoping Meeting. A public Scoping Meeting was conducted on June 7, 1982 in Cross Roads, Texas.


Cedar Creek Reservoir
ATHENS
St Louis Southwestern
Southern Pacific
Lake Palestine
MALAKOFF
TRINIDAD
CORSICANA
MALAKOFF EGS SITE
TRINITY MINE
Henderson Co.
Anderson Co.
Navarro Co.
St Louis Southwestern
PROJECT SITE
Trinity River
Neches River
PALESTINE
19
31
175
59
90
22
45
287
155
79
84
294
Enlarged Area
LOCATION MAP
N
SCALE
0 10 20 30
Kilometers
0 5 10 20
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 3-1

GENERAL LOCATION MAP

A Responsiveness Summary for the June 7 meeting was prepared by EPA and distributed to interested parties on June 29, 1982.

The objective of the EIS is to allow public input into EPA's decision-making process. The EIS will assist EPA in making its decision to issue, deny or attach conditions to the NPDES Permits. The EIS will be used by EPA to determine the impact of the project on environmental resources including air, water, prime farmland, wetlands, fish and wildlife, cultural resources and socioeconomic conditions. Should the environmental review identify significant adverse impacts, the EIS will also identify mitigative measures that can be employed by the applicants to reduce or eliminate the severity of those adverse impacts.

3.2 OTHER FEDERAL, STATE AND LOCAL LEGISLATIVE REQUIREMENTS

Compliance or conformance with Federal, State and local laws and regulations are required before HL&P, NACCO, UFI and UNRMWA can construct and operate the proposed facilities included as a part of the Malakoff EGS/Trinity Mine Project. These requirements include performance standards, effluent limitations, agency reviews and approvals, and interagency coordination. A list of applicable regulations and/or permits is presented in Table 3-1.

3.3 DESCRIPTION OF THE APPLICANTS

3.3.1 Houston Lighting & Power Company

In its 101st year of operation, Houston Lighting & Power Company is one of the fastest growing electric utilities in the country today.

On December 17, 1882, HL&P's first generating plant went into operation serving some 40 customers with arc light service. Since that time, Houston Lighting & Power Company has grown to a company that now serves more than one million customers.

HL&P provides electricity to 158 cities and towns in a 12,960-km^2 (5,000-mi^2) area on the Houston-Gulf Coast that boasts a population of nearly three million people. This service area represents only about two percent of Texas' land area, but it contains nearly one quarter of the state's population and consumes about 35 percent of the state's electricity.

TABLE 3-1

FEDERAL, STATE AND LOCAL PERMITS/REGULATIONS/APPROVALS/REVIEWS APPLICABLE TO THE PROPOSED MALAKOFF EGS/TRINITY MINE PROJECT

Permit, Regulation or Approval	Applicant(s)[a]	Agency[b]
NPDES Permit, Section 402 of the Clean Water Act	HL&P, NACCO	USEPA
Dredge and Fill Permit, Section 404 of the Clean Water Act	HL&P, NACCO, UFI, UNRMWA	USCE
Compliance with Endangered Species Act of 1973 as amended	HL&P, NACCO, UFI, UNRMWA	USFWS
Compliance with the National Historic Preservation Act of 1966, as amended, and Executive Order 11593	HL&P, NACCO, UFI, UNRMWA	ACHP, SHPO, USEPA, USCE
Compliance with Archaeological and Historic Preservation Act of 1974	HL&P, NACCO, UFI, UNRMWA	ACHP, SHPO, USEPA, USCE
Compliance with Federal Aviation Administration Regulations	HL&P	FAA
Compliance with the Fish and Wildlife Coordination Act	HL&P, NACCO, UFI, UNRMWA	USFWS
Compliance with Wild and Scenic Rivers Act of 1968	UNRMWA	NPS
Prevention of Significant Deterioration (PSD) Permit and/or Review under Clean Air Act	HL&P, NACCO, UFI	TACB/USEPA
Construction Permits	HL&P, NACCO, UFI	TACB/USEPA
Operating Permits	HL&P, NACCO, UFI	TACB/USEPA
Certificate of Convenience and Necessity	HL&P	PUC
Surface Coal Mining Permit	NACCO	RRC
Appropriation of State Water Permit	HL&P	TDWR
Wastewater Discharge Permit	HL&P, NACCO	TDWR
Solid Waste Registration	HL&P	TDWR
Flood Plain Management, Stream Diversions	NACCO, HL&P	SCS, RRC, HCLID, TDWR, FEMA
Road Relocations	NACCO	RRC, THD, CC

TABLE 3-I (Concluded)

a. HL&P - Houston Lighting & Power Company
NACCO - The North American Coal Corporation and Getty Oil Company
UFI - Utility Fuels, Inc.
UNRMWA - Upper Neches River Municipal Water Authority

b. USEPA - United States Environmental Protection Agency
USCE - United States Department of the Army, Corps of Engineers
USFWS - United States Department of the Interior, Fish and Wildlife Service
FAA - Federal Aviation Administration
ACHP - Advisory Council on Historic Preservation
SHPO - State Historic Preservation Officer of Texas
NPS - United States Department of the Interior, National Park Service
TACB - Texas Air Control Board
PUC - Public Utilities Commission of Texas
RRC - Railroad Commission of Texas
USDOT - United States Department of Transportation
SCS - United States Department of Agriculture, Soil Conservation Service
TDWR - Texas Department of Water Resources
FEMA - Federal Emergency Management Administration
HCLID - Henderson County Levy Improvement District
THD - State Department of Highways and Public Transportation
CC - County Commissioners of Henderson and Anderson counties

Headquartered at 611 Walker in downtown Houston, HL&P has more than 9,000 employees and a total generating capability of 11,600 megawatts. Ten power plants make up the company's generating system. About 80 percent of the company's generating capacity is fueled by natural gas. In 1978, HL&P placed its first coal-fired generator in service. Today, it has three coal units in operation and will complete a fourth in late 1982. Coal for these units is being transported by rail from Wyoming and Montana.

As a result of having to keep up with the demands of one of the fastest growing areas in the country, HL&P has one of the largest power plant construction programs of any electric utility in the U. S.

In the next 10 years, HL&P projects it will spend $11 billion on construction in order to satisfy the electric needs of a population that has been growing at a rate of nearly 100,000 people a year.

In addition to its fourth coal-fired generator that will be completed in late 1982, HL&P is involved in one nuclear project and two lignite projects, including the Malakoff EGS, which was announced in December 1981. Another lignite plant is under construction in Limestone County.

HL&P is project manager of the South Texas Project (STP), a jointly-owned nuclear plant under construction in Matagorda County between Bay City and Palacios. STP's two 1,250-megawatt units are scheduled for commercial operation in 1987 and 1989.

When the Malakoff and Limestone lignite units are all in operation in 1990, HL&P expects to be burning about 11.8 million metric tons (13 million tons) of lignite a year.

3.3.2 The North American Coal Corporation/Getty Oil Company

The Trinity Mine is jointly owned by The North American Coal Corporation and Getty Oil Company (The Joint Venture), with NACCO as operator. NACCO's corporate headquarters are located at 12800 Shaker Boulevard, Cleveland, Ohio. NACCO employs 4,745 persons and has four Divisions, two of which are surface mining operations and two of which are underground mining operations.

The Southwestern Division of NACCO is located at 13140 Coit Road, Dallas, Texas and is responsible for the construction and operation of the Trinity Mine. The Joint

Venture finalized an agreement to supply lignite to two 600-megawatt (net) electric generating units to be built by the Houston Lighting & Power Company in eastern Texas. Under the terms of the 30-year agreement, approximately 6.5 million tons of lignite per year will be mined. The Sabine Mining Company, a subsidiary of NACCO's Southwestern Division, is constructing the South Hallsville No. 1 Mine in eastern Texas to supply lignite from reserves controlled by Southwestern Electric Power Company (SWEPCO) to the mine-mouth, 640-megawatt Henry W. Pirkey Power Plant. Lignite will be delivered at an annual rate of 2.8 million tons with deliveries beginning in the fourth quarter of 1984 and continuing for approximately 25 years.

Headquartered in Bismarck, North Dakota, the Western Division of NACCO has reserves of more than four billion tons of lignite within the state. The Falkirk Mine, which began producing in 1978, mined 3.7 million tons of lignite last year (1981). The Falkirk Mine supplies lignite to the mine-mouth 1100-megawatt Coal Creek Generating Station owned by the Cooperative Power Association and the United Power Association. Based on more than 300 million tons of lignite reserves, Falkirk has the capability of producing six million tons annually. The Indian Head Mine mined over one million tons of lignite in 1981. United Power Association (UPA) is constructing a supplemental boiler which will increase its generating capacity. The Indian Head Mine will supply 1.2 million tons in 1983. The Coteau Properties Company's Freedom Mine will start delivering lignite to a utility customer next year. The Freedom Mine will be capable of producing up to 9.9 million tons of lignite annually. Coteau has been proceeding with preparations for a mine that will supply 5.2 million tons of lignite annually for use at the mine-mouth 900-megawatt Antelope Valley Generating Station being constructed by Basin Electric Power Cooperative. In addition, The Great Plains Gasification Associates, a group of natural gas transmission companies, is constructing the nation's first commercial coal gasification plant based on Coteau's lignite reserves. When completed in late 1984, the plant will consume up to 4.7 million tons of lignite annually.

The Central Division of NACCO is located in Ohio and is responsible for underground mining of bituminous coal from the Company's reserves in southeastern Ohio. Coal will be mined for Ohio Edison's Burger Power Plant, Dilles Bottom, Ohio, at a rate of approximately 80,000 tons per month. Total reserves at this mine contain 28 million tons. The NACCO Mining Company, which controls approximately 79 million tons of bituminous coal reserves, has a long-term sales contract with The Cleveland Electric Illuminating Company (CEI). Production from NACCO's Powhatan No. 6 Mine at Alledonia, Ohio is shipped to CEI's Eastlake and Ashtabula, Ohio generating stations. The Mine currently is capable of producing over 1.6 million tons of bituminous coal and tonnage levels could be increased in the event of higher customer demands. Quarto Mining Company supplies coal to The Central Area Power Coordination Group at the Bruce Mansfield Plant in Shippingport, Pennsylvania. Quarto Mining Company expects aggregate annual production of 2.1 million tons of coal. Quarto's reserves amount to 169 million tons of coal.

The Eastern Division of NACCO is located in Pennsylvania. Coal produced by The Florence Mining Company's two mines, supplemented by purchased coal, was supplied to the Conemaugh Generating Station. The mines produced 1.6 million tons of bituminous coal in 1981. Production at The Helen Mining Company's Homer City No. 1 Mine in Homer City, Pennsylvania was 846,000 tons in 1981. This Mine supplies half of the tonnage required by the Homer City Generating Station. Both Eastern Division subsidiaries have substantial reserves of bituminous coal - Florence Mining, 76 million tons, and Helen Mining, 64 million tons - and production at their mines could be expanded should requirements of their customers increase.

Getty Oil Company is an integrated petroleum company engaged in searching for and producing crude oil and natural gas and in transporting, refining and marketing petroleum and petroleum products. The company also explores for, produces and sells minerals other than petroleum and is involved in synthetic fuels projects. Other company activities include property and casualty reinsurance and life insurance; chemicals manufacturing and marketing; television sports programming; agricultural production; and management of real estate and forest products properties.

At year-end 1981, Getty had approximately 19,100 employees, including those at its insurance and other subsidiaries. Corporate headquarters are located at 3810 Wilshire Boulevard, Los Angeles, California.

In the minerals area, Getty currently operates the Mercur Gold Mine in Utah and the Petrotomics Uranium Mine in Wyoming's Shirley Basin. In addition to these operating mines, Getty is evaluating the feasibility of developing copper reserves in Arizona, oil shale in Colorado and molybdenum in Utah.

In addition to involvement in the Trinity Mine, Getty owns the Colorado Yampa Coal Company located near Steamboat Springs, Colorado, which produced 3.5 million tons from three surface mines in 1981 and employed 379 miners. At the present time, this operation is the largest surface coal mine in Colorado.

In Utah, Getty operates the Plateau Mine underground mine near Price. In 1981, this operation produced 1.2 million tons and employed 307 miners. The Skyline Mine near Schofield, Utah in which Getty is a joint venture partner was opened in 1981 and is scheduled to produce 5 million tons of underground coal when it becomes fully operational in 1987. The Getty Oil Company's coal department offices are located at 5250 South 300 West, Salt Lake City, Utah.

3.4 NEED FOR THE PROPOSED PROJECT

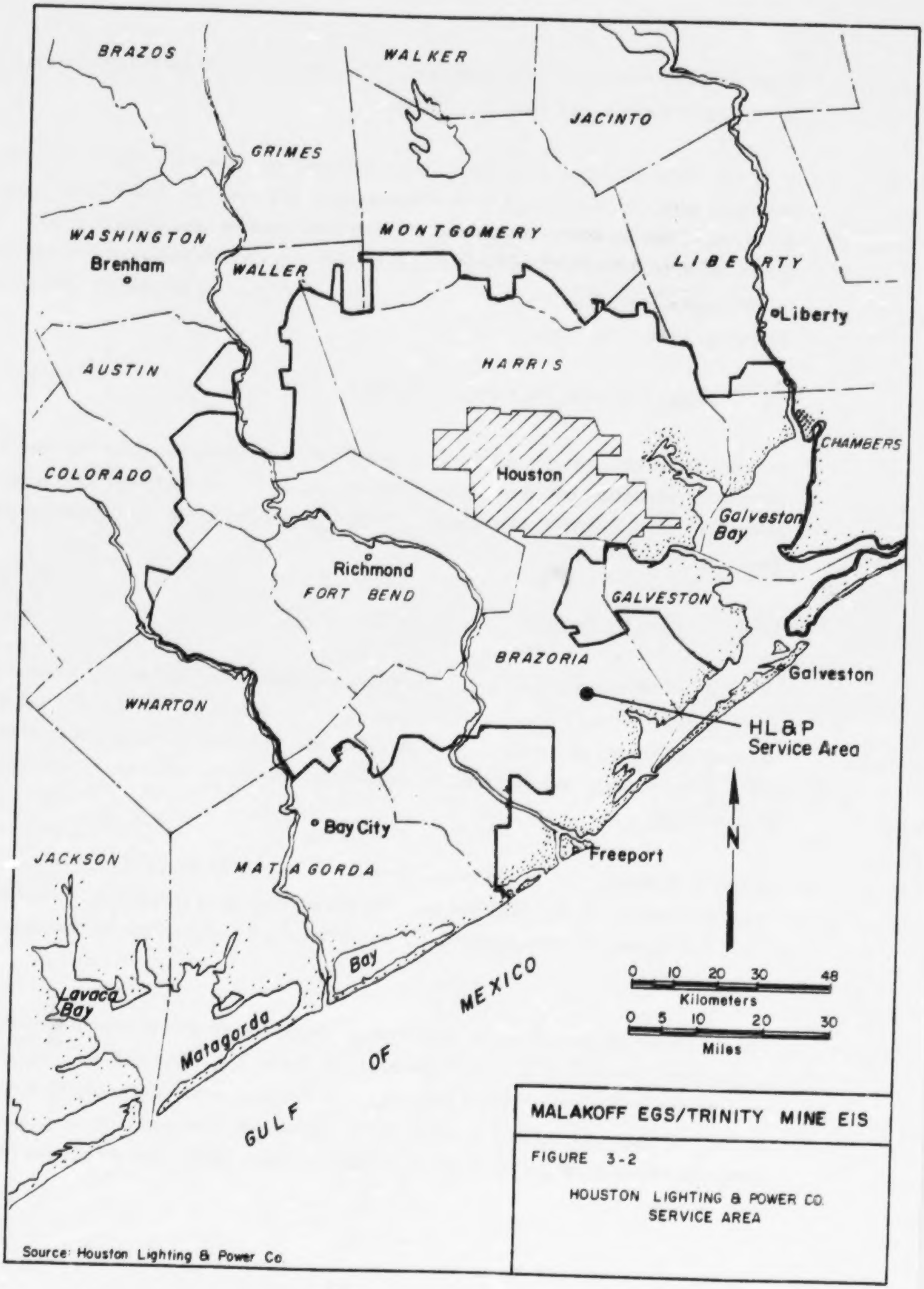
In order to reliably meet the projected growth in peak demand which will result from increasing population and growing commerical and industrial sectors, HL&P proposes to construct two 600-MW lignite-fueled electric generating units in Henderson County, Texas.

3.4.1 Need for Power

HL&P is engaged in the generation, transmission, distribution and sale of electric energy for a 12,960-km^2 (5,000-mi^2) contiguous area on the Gulf Coast of Texas (Fig. 3-2). The area served covers all or parts of 12 counties and includes the major cities of Houston, Galveston, Pasadena and Baytown, as well as approximately 150 other cities, towns and communities.

HL&P is a member of the Electric Reliability Council of Texas (ERCOT), one of nine regional councils of the National Electric Reliability Council (NERC). Membership in ERCOT includes 26 municipalities, 50 cooperatives, 8 investor-owned companies and 1 state agency.

For the HL&P service area, the projected compound annual growth rate in peak demand is 2.8 percent for 1981-1986 and 3.1 percent for 1986-1991. To meet this projected load growth, the 1981 system capability of 12,263 MW will be expanded to 16,383 MW by 1991. Such an expansion of system capability takes into account the necessity of maintaining an adequate reserve margin to preserve reliability (Table 3-2). The population of HL&P's


BRAZOS
WALKER
JACINTO
GRIMES
WASHINGTON
Brenham
MONTGOMERY
WALLER
LIBERTY
Liberty
AUSTIN
HARRIS
CHAMBERS
Houston
COLORADO
Galveston Bay
Richmond
FORT BEND
GALVESTON
BRAZORIA
Galveston
WHARTON
HL&P Service Area
N
Bay City
Freeport
JACKSON
MATAGORDA
Bay
Lavaca Bay
Matagorda
GULF OF MEXICO
0 10 20 30 48
Kilometers
0 5 10 20 30
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 3-2

HOUSTON LIGHTING & POWER CO.
SERVICE AREA

Source: Houston Lighting & Power Co

TABLE 3-2

GENERATION, DEMAND, CAPABILITY AND RESERVE FOR HOUSTON LIGHTING & POWER COMPANY SYSTEM

Year	Net Generation and Purchases (GWH)	Peak Demand[a] (MW)		Net Capability at Peak[b] (MW)		Reserve	
						(MW)	(%)
1971	30,888	5,308	(222)	6,245		937	17.65
1972	34,468	6,010	(228)	7,295		1,285	21.38
1973	36,694	6,484	(224)	7,708		1,224	18.88
1974	38,191	6,930	(220)	8,760		1,830	26.41
1975	40,276	7,252	(213)	9,510		2,258	31.14
1976	43,355	8,019	(200)	9,810		1,791	22.33
1977	48,534	8,445	(200)	10,170		1,725	20.43
1978	53,323	9,114	(248)	10,828		1,714	18.81
1979	55,057	9,336	(266)	11,193		1,857	19.89
1980	57,948	10,266	(269)	12,263	(500)	1,997	19.45
1981[c]	59,539	10,540	(279)	12.563	(800)	2,023	19.19
1982	62,584	10,900	(0)	13,063	(1,300)	2,163	19.85
1983	65,017	11,150	(0)	13,613	(1,200)	2,463	22.09
1984	67,831	11,325	(0)	13,413	(1,000)	2,088	18.44
1985	70,262	11,800	(0)	13,713	(1,300)	1,913	16.22
1986	72,073	12,100	(0)	14,013	(900)	1,913	15.82
1987	73,532	12,475	(0)	15,398	(1,200)	2,923	23.44
1988	75,318	12,925	(0)	14,798	(0)	1,873	14.50
1989	78,257	13,300	(0)	15,783	(0)	2,483	18.67
1990	80,966	13,550	(0)	15,783	(0)	2,233	16.48
1991	84,171	14,100	(0)	16,383	(0)	2,283	15.99

a. Does not include interruptible load. Numbers in parentheses indicate amount of interruptible load at time of system peak.

b. Capability includes purchased capacity. Purchases are in parentheses.

c. Actuals through 1981; forecast data for 1982-1991.

service area in 1981 was estimated to be 3,239,000. This is expected to increase at a rate of slightly under 3 percent per year, resulting in an absolute increase of nearly 1,000,000 residents by 1991 (Table 3-3). This increase in population will significantly increase the number of electric customers. Table 3-4 compares the number of customers in 1981 and 1991. The largest increase is expected to occur in the residential sector in which the number of customers is anticipated to increase 47 percent over the period 1981-1991. Table 3-5 shows the actual MWH sales to each class of customers in 1981 and the expected sales in 1991. Industrial customers remain the major consumers of electric power, using over 50 percent of total HL&P generation, though they represent less than 0.15 percent of total number of customers.

Attendant with the population increase and commercial and industrial expansion, total peak demand for the HL&P system is projected to rise from 10,540 MW in 1981 to 14,100 MW in 1991 (Table 3-2). Included in Table 3-2 is the effect of HL&P purchase agreement for firm power with the City of Austin and City Public Service Board of San Antonio (CPSB). The City of Austin contract gives HL&P up to 800 MW in each of the years 1980 through 1987. HL&P's contract with the City Public Service Board of San Antonio provides for 500 MW in 1982, 400 MW in 1983, 200 MW in 1984, 500 MW in 1985, 200 MW in 1986 and 400 MW in 1987. The planned installed capability, plus the additional planned power purchases, will provide HL&P with adequate reserves.

To meet the anticipated growth in demand, HL&P will install new generating capacity as outlined in Table 3-6, which also includes existing units categorized by type of service. The two lignite-fueled units proposed for 1988 and 1989 (each comprising a 600 net MW addition to the system capability) are an integral part of HL&P's plan to meet its obligation of providing reliable electric power to its service area. When further considering that the service to this area includes an industrial load representing a large part of the economic base of the southwest and the nation, it is evident that failure to meet the demands of load growth could have far-reaching economic and social consequences.

3.4.2 Fuel Resource Requirements

Through the end of 1977, HL&P relied almost exclusively on natural gas as a source of fuel. In the late 1960s, HL&P recognized that it could no longer rely on natural gas as a boiler fuel for its new generating units. No gas-fired boilers have been planned since the

TABLE 3-3

ESTIMATED HISTORICAL AND PROJECTED FUTURE HOUSTON LIGHTING & POWER COMPANY SERVICE AREA POPULATION AND ANNUAL ENERGY CONSUMPTION[a]

Year	Population			Annual MWH Sales (000)	Increase in MWH	
	Number[b]	Increase Amount	Increase %		(000)	(%)
1971	2,264,000	74,000	3.4	28,623	2,575	9.9
1972	2,339,000	75,000	3.3	32,500	3,877	13.5
1973	2,427,000	88,000	3.8	34,701	2,201	6.8
1974	2,527,000	100,000	4.1	35,807	1,106	3.2
1975	2,621,000	94,000	3.7	38,147	2,340	6.5
1976	2,706,000	85,000	3.2	40,859	2,712	7.1
1977	2,803,000	97,000	3.6	45,886	5,027	12.3
1978	2,912,000	109,000	3.9	50,276	4,390	9.6
1979	3,023,000	111,000	3.8	52,361	2,085	4.1
1980	3,131,000	108,000	3.6	54,804	2,443	4.7
1981	3,239,000	108,000	3.4	56,880	2,076	3.8
1982	3,346,000	107,000	3.3	59,290	2,410	4.2
1983	3,453,000	107,000	3.2	61,590	2,300	3.9
1984	3,559,000	106,000	3.1	64,304	2,714	4.4
1985	3,664,000	105,000	3.0	66,613	2,309	3.6
1986	3,768,000	104,000	2.8	68,331	1,718	2.6
1987	3,872,000	104,000	2.8	69,702	1,371	2.0
1988	3,974,000	102,000	2.6	71,364	1,662	2.4
1989	4,073,000	99,000	2.5	74,109	2,745	3.8
1990	4,171,000	98,000	2.4	76,680	2,571	3.5
1991	4,266,000	95,000	2.3	79,690	3,010	3.9

a. Annual Average Population.

b. 1980-1991 data are based on 8101-LMGT Forecast.

TABLE 3-4

NUMBER OF CUSTOMERS

(Year Average)

	1981 (Actual)	1991 (Projected)
Residential	950,577	1,412,554
Commercial	129,660	167,429
Industrial	1,660	2,443
Gov., Mun., & Public Utilities	76	76
Total System	1,081,973	1,582,502

TABLE 3-5

MWH SALES

	1981 (Actual)		1991 (Projected)	
	Sales	Percent of Total	Sales	Percent of Total
Residential	12,917,957	23	20,357,126	26
Commercial	9,901,638	17	12,313,236	15
Industrial	30,564,665	54	40,764,482	51
Gov., Mun., & Public Utilities	3,496,102	7	6,252,074	8
Total System	56,880,363	100	79,687,355	100

TABLE 3-6

INSTALLED AND PROPOSED GENERATING UNITS FOR THE HOUSTON LIGHTING & POWER COMPANY SYSTEM

Station	Unit No.	Capability (MW)	Type of Service[a]	Proposed Date of Addition Yr/Mo
Units Currently in Operation				
S. R. Bertron	1	174	Base	
	2	174	Base	
	3	230	Base	
	4	230	Base	
	G1	23	Peaking	
	G2	13	Peaking	
Cedar Bayou	1	750	Base	
	2	750	Base	
	3	750	Base	
Champion	1	6	Base	
	2	4	Base	
	3	12	Base	
H. O. Clarke	1	44	Peaking	
	2	44	Peaking	
	3	77	Intermediate	
	4	77	Intermediate	
	G1	13	Peaking	
	G2	13	Peaking	
	G3	13	Peaking	
	G4	13	Peaking	
	G5	13	Peaking	
	G6	13	Peaking	
Deepwater	7	167	Base	
Greens Bayou	1	70	Peaking	
	2	70	Peaking	
	3	112	Intermediate	
	4	112	Intermediate	
	5	398	Base	
	73	56	Peaking	
	74	56	Peaking	
	81	64	Peaking	
	82	64	Peaking	

TABLE 3-6 (Cont'd)

Station	Unit No.	Capability (MW)	Type of Service[a]	Proposed Date of Addition Yr/Mo
	83	64	Peaking	
	84	64	Peaking	
W. A. Parish	1	169	Base	
	2	174	Base	
	3	278	Base	
	4	555	Base	
	5	660	Base	
	6	660	Base	
	7	570	Base	
	GI	13	Peaking	
P. H. Robinson	1	441	Base	
	2	441	Base	
	3	565	Base	
	4	750	Base	
	GI	13	Peaking	
Webster	1	109	Intermediate	
	2	109	Intermediate	
	3	375	Base	
	GI	13	Peaking	
T. H. Wharton	1	71	Peaking	
	2	229	Base	
	3	237	Base	
	4	237	Base	
	51	58	Peaking	
	52	58	Peaking	
	53	58	Peaking	
	54	58	Peaking	
	55	58	Peaking	
	56	58	Peaking	
	GI	13	Peaking	
Units Reserved for Emergency Only[b]				
Deepwater	1-6	61		
Gable Street	6-7	62		

TABLE 3-6 (Concluded)

Station	Unit No.	Capability (MW)	Type of Service[a]	Proposed Date of Addition Yr/Mo
Proposed Units (in Order of Addition)				
W. A. Parish	8	540	Base	1982/12
Limestone	1	700	Base	1986/04
Limestone	2	700	Base	1987/04
South Texas Project	1	385	Base	1987/06
Malakoff	1	600	Base	1988/03
Malakoff	2	600	Base	1989/03
South Texas Project	2	385	Base	1989/06

a. Based on average capacity factors for 1973-78: base, 36 to 100 percent; intermediate, 16 to 35 percent; peaking, 0 to 15 percent.

b. Capability ratings on emergency-use-only units not included in total system capability.

early 1970s, when HL&P embarked on a fuel diversification plan which specified that all additions to base load generating capacity be powered by nuclear fuel or coal. Because of actual and potential gas curtailments, there was an additional program to convert substantial gas-fired boiler capacity to oil.

Approximately 46 percent of HL&P capacity can now burn oil continuously; additionally, approximately 16 percent of present capacity is represented by three new coal-fired units. Ultimately, the HL&P program is committed to the same goal as the National Energy Act: significant reductions of natural gas and oil as boiler fuels. Therefore, in accordance with the spirit of national energy legislation and particularly the Powerplant and Industrial Fuel Use Act of 1978 (FUA), the HL&P program for fuel diversification will reduce the share of natural gas in the fuel mix. The Omnibus Reconciliation Act of 1981 will allow HL&P to continue burning natural gas for the full lives of its existing gas-fired generating units.

The percentage breakdown of fuel requirements based on megawatt hour generation for 1981 and those projected for 1986 and 1991 are as follows:

Percent Fuel Requirement

	1981	1986	1991
Purchased	4	6	0
Gas	77	66	52
Oil	1	2	1
Coal	18	23	21
Lignite	0	3	20
Nuclear	0	0	6

For the reasons listed in Sec. 4.3 of this document, HL&P has elected to use lignite as the preferred fuel for the Malakoff EGS. After evaluation of several alternative lignite reserves, HL&P chose the Trinity Mine as supplier of the fuel.

4.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES

This chapter presents relevant information regarding various project alternatives considered by the applicant(s), including the no action alternative. Two basic alternatives were considered by HL&P: 1) alternative means that could conceivably meet the power demand without requiring the creation of new generating capacity; and 2) alternative means of creating new generating capacity.

As demonstrated in Sec. 4.2, several alternatives were evaluated to meet the increased electrical demand within the HL&P service area, without the creation of new generating capacity; all to no avail.

Once it was determined that new generating capacity was required, HL&P evaluated several alternative fuels. As discussed in Sec. 4.3, HL&P selected Texas lignite as the fuel for the required new generation. This decision was based on HL&P's desire for fuel diversification, the mandates of the Fuel Use Act, the political entanglement of nuclear licensing which has lengthened the time required for design, licensing and construction, the high transportation costs of western coal, and the availability and relatively low cost of lignite.

Once the type of fuel was selected, HL&P evaluated several Texas lignite reserves. This evaluation was primarily an economic comparison which also considered mine plan development and availability of a suitable power plant site. After review of these lignite reserves, HL&P selected the Trinity Mine, jointly owned by The North American Coal Corporation and Getty Oil Company, as the fuel supplier for the required new generating station. With the fuel source identified, HL&P commissioned a siting study to determine the best location for the generating station. Five candidate sites were identified. The following considerations were evaluated during the screening process:

1) Geotechnical
2) Air Quality
3) Hydrology
4) Ecology
5) Land Use, Aesthetics and Noise
6) Socioeconomics
7) Economics

Based on the results of the evaluation, the Malakoff EGS site was selected by HL&P as the preferred alternative.

HL&P also evaluated 129 possible sources or combination of sources of water for the proposed Malakoff EGS. All but four of these were eliminated by basic physical, licensing or economic considerations. Of the four potentially feasible sources of water, HL&P selected water from the Upper Neches River Municipal Water Authority. The proposed diversion point is located approximately 0.8 km (0.5 mi) upstream of an existing channel dam on the Neches River and approximately 43.5 river kilometers (27 river miles) downstream of Lake Palestine.

Other alternatives considered by HL&P included various plant layouts and process designs. These alternatives are discussed in detail in Sec. 4.4.1.

Alternatives considered by NACCO/Getty included:

1) Alternative mining methods;
2) Alternative overburden handling techniques;
3) Alternative lignite loading techniques;
4) Alternative methods of lignite transportation;
5) Alternative reclamation strategies.
6) Alternative post-mining land uses; and
7) Alternative sand and gravel handling techniques.

These alternatives are discussed in Sec. 4.4.2.

4.1 NO ACTION ALTERNATIVE AVAILABLE TO THE APPLICANTS

The no action alternative could be implemented by the permit applicants of their own choice. Implementation of the no action alternative would mean that:

1) the applicants would redesign the project so that no point source discharge would occur; or

2) site preparation, construction and operation of the proposed project would not occur.

The former is not a cost-effective alternative for the power plant and not a technologically feasible alternative for the mine. Therefore, the effect of the no action alternative is no project.

Furthermore, as discussed in Sec. 3.4, no other reasonable alternative could be developed in sufficient time to supply the additional electricity required by HL&P's customers in 1988 and maintain an adequate reserve margin, if the no action alternative were pursued.

4.2 ALTERNATIVES NOT REQUIRING THE CREATION OF NEW GENERATING CAPACITY

Four conceivable means of meeting the electric demand without the creation of new generating capacity were considered. These include: 1) energy conservation; 2) power purchases; 3) reactivation or upgrading of older units, and 4) baseload operation of existing peaking facilities.

4.2.1 Energy Conservation

HL&P has sought to reduce the growth of demand through advertising which emphasizes energy conservation through elimination of wasteful practices, installation of home insulation and weatherproofing, and the use of high-efficiency appliances. However, as discussed in Sec. 3.4.1, a major portion of the total electric demand is from industrial and commercial customers. Significant decreases in these demands cannot be expected without corresponding decreases in production or major plant modification.

On-going market studies and surveys are being conducted which will show the effects of conservation on demand. However, the proposed lignite units will be used not only to supply projected increases in demand but also to reduce oil/gas boiler fuel requirements. Therefore, energy conservation measures leading to reduced load growth cannot be expected to have sufficient impact to reduce the need for the Malakoff EGS.

4.2.2 Purchased Power

As stated in Sec. 3.4.1 of this document, HL&P has entered into power purchase agreements with the City of Austin and City Public Service Board of San Antonio. The City of Austin contract gives HL&P up to 800 MW in each year from 1980 through 1987. HL&P's contract with the City Public Service Board of San Antonio provides for 500 MW in 1982, 400 MW in 1983, 200 MW in 1984, 500 MW in 1985, 200 MW in 1986 and 400 MW in 1987. Neither of these agreements for firm power currently extends past 1987. The planned installed capability, plus the additional planned power purchases, will provide HL&P with adequate reserves. The two lignite-fueled units proposed for the Malakoff EGS for 1988 and 1989 are an integral part of HL&P's plan to meet its obligation of providing reliable electric power to its service area.

In summary, purchased power is part of the solution to providing adequate firm power capability but cannot be considered a substitute for required new system owned generating capability.

4.2.3 Reactivation or Upgrading of Older Units

All units which were retired before 1980 have been dismantled and cannot be reactivated. Presently, the only units available for reactivation are currently maintained as emergency-use-only units with an installed capacity of only 123 MW or approximately 10.25 percent of the net output of the two proposed lignite-fired units.

HL&P has studied upgrading several of its older units to increase output. These studies indicate that only a maximum of 100 MW could be realized as a result of such upgrading. In general, the older units are limited by the installed boiler forced-draft fans. If these are replaced, auxiliary capabilities (turbine generator or boiler feed pump) become the next limitation. These changes could be made, but this alternative does not provide a solution for meeting future demands since the amount of generating capacity which can be gained is only 8 percent of the net output of the two proposed lignite-fired units.

4.2.4 Baseload Operation of Existing Peaking Facilities

HL&P's customary peaking capability is approximately 1,181 MW of existing facilities. To convert these units to base-load operation could jeopardize reliability of the HL&P

system. The conversion of peaking facilities to base-load operation does not add capacity to the system; energy output may be increased, but there is no addition to the system's ability to meet increased peak demand resulting from projected growth.

Another problem with operating the peaking facilities in a base-load mode is their inefficiency. For example, many peaking facilities employ either combustion turbines or older nonreheat boilers. These units typically have heat rates of 13,500 to 22,000 BTU/kwh. The existing intermediate and base-load fossil-fueled units have heat rates typically in the range of 9,000 to 13,000 BTU/kwh. The proposed lignite units have an estimated heat rate of 11,300 BTU/kwh. Clearly, the operation of peaking facilities in a base-load mode would be an inefficient use of fossil fuel and of total energy.

4.3 ALTERNATIVE ENERGY SOURCES

4.3.1 Geothermal

Four basic types of geothermal resources exist: dry steam, petrothermal, hydrothermal and geopressured. These types of geothermal resources are separated by their hydrologic and thermodynamic characteristics. Each is discussed in more detail below.

4.3.1.1 Dry Steam

The most successful geothermal power developments to date are dry steam systems. However, this type of geothermal resource is relatively rare and the total resources for dry steam are very limited. Notable development of this type of geothermal resource is The Geysers, in northern California. Total resource estimates for the United States are about 2000 MWe, most of which is limited to the western U. S. Insufficient dry steam resources exist within Texas to be considered an alternative to the proposed Malakoff EGS.

4.3.1.2 Petrothermal

It is theorized that large amounts of hot, dry rock exist in both molten and solid form at vast depths within the earth's crust. Research is underway for methods to introduce water into petrothermal systems and extracting heated water and steam from wells adjacent to injection wells. The technological feasibility of power production at the levels to be provided by the Malakoff EGS has not been demonstrated. Therefore, it is not considered a feasible alternative to the Malakoff EGS.

4.3.1.3 Hydrothermal

Hydrothermal-geothermal energy is widespread. Commercially exploitable deposits, however, are not known to occur in Texas. The best hydrothermal resources in the U. S. occur in the western one-third of the country, and Alaska and Hawaii. Due to the lack of commercially exploitable reserves in Texas, this alternative is not considered a viable alternative to the proposed Malakoff EGS.

4.3.1.4 Geopressured Resources

Geopressured reservoirs do occur along the Gulf Coast of the U. S. These reservoirs are located in deep sedimentary strata where effective shale seals have formed. Research is currently underway to determine the engineering and economic feasibility for the exploitation of these geopressured resources. However, due to the lack of knowledge regarding feasibility, geopressured-geothermal is not considered a viable alternative to the Malakoff EGS within the time frame required for new generating capacity.

4.3.2 Solar

4.3.2.1 Photovoltaic Conversion

Solar energy can be converted directly to electricity through photovoltaic conversion by solar cells. Theoretical conversion of silicon solar cells is about 23 percent. However, photovoltaic conversion appears economically unattractive because the current manufacturing costs of solar cells are approximately $13,000 to $15,000 per peak kW (Bos, 1980). Such costs make using photovoltaic conversion devices an uneconomical alternative to the proposed baseload lignite-fueled Malakoff EGS.

4.3.2.2 Solar Thermal Conversion

Central receiver solar thermal conversion systems would require solar collectors and concentrators, a liquid medium (either water or liquid sodium) as a heat transfer system and a turbogenerator to produce electricity. The basic problems associated with baseload power generation through solar thermal conversion are related to: 1) the variability of solar radiation, which requires electrical or thermal storage, or a backup power source; and 2) the low density of solar radiation which requires substantial land areas devoted to energy collection. An area of approximately 3,108 ha (12 mi^2) would be required for the solar collectors of a plant of similar size to the proposed Malakoff EGS in the southwestern United States. Capital costs for the design and construction of a central receiver solar station are also extremely high. Therefore, even with free fuel, the economics and the need for backup power supplies do not allow serious consideration of a baseload central receiver solar plant as a viable alternative for the proposed Malakoff EGS within the time frame required for new generating capacity.

4.3.3 Wind

Large-scale electrical generating systems (over 100 MW) are now in the stage of design, development and testing. Information from on-going demonstration units will eventually provide the necessary data to determine economic, environmental and operational feasibility. A large scale "wind farm" was not considered a viable alternative to the proposed Malakoff EGS due to: 1) intermittent operation due to changing wind levels; 2) the resultant need for energy storage devices; and 3) the lack of demonstrated operating feasibility of large scale units.

4.3.4 Coal and Petroleum Gasification

Synthetic fuels from domestic coal and oil shale cannot be considered as a viable alternative source of fuel due to the economics involved. Recent decisions to defer major synthetic fuel facilities in east Texas and Colorado were largely based on competitive economics of other fuel sources. Until the cost of alternative energy sources increase to the level that make synthetic fuels economically competitive, little activity in coal and petroleum gasification is anticipated.

4.3.5 Natural Gas

Shortages of natural gas occurred early in 1973. This shortage resulted in the Federal Power Commission (FPC) issuing Order No. 467 (Federal Register, 1973) that set forth initial priorities based on end use of gas to be followed by the various pipeline companies. Users of natural gas with the lowest priority are those with interruptible requirements of more than 283,200 m^3 (10,000 mcf) per day where alternative fuel capabilities can meet such requirements. The position of the FPC was that the use of natural gas as a boiler fuel is an inferior end use and that all such large quantity sales for use in boilers should be made under interruptible rather than firm contracts.

The Federal Energy Administration (FEA) adopted a rule on May 5, 1975, to implement Sections 2(c), (b) and (c) of the Energy Supply and Environmental Coordination Act of 1974 (P. L. 93-319) which prohibited certain power plants and major fuel burning installations from burning petroleum products or natural gas as their primary energy source. Utilities were advised by the FEA that gas use for electric power generation must be phased out. They were further informed that burning oil was also being restricted. The Powerplant and Industrial Fuel Use Act of 1978 superseded the Energy Supply and Environmental Coordination Act of 1974. The FUA provided a clear mandate against the use of natural gas or petroleum as a primary energy source by new power plants. It also prohibited the use of natural gas by existing power plants after 1990 unless an exemption was obtained. In 1981, the FUA was amended to relax the phase-out requirements on the use of natural gas, but the restrictions on its use as a boiler fuel in new power plants were retained.

Because of restrictions on use imposed by the FUA and because future supplies are expected to increase in price, natural gas was not found to be a viable fuel source for the proposed base-load Malakoff EGS.

4.3.6 Western Coal

Western coal is currently being considered as a fuel supply for future electric generation by HL&P. Currently, HL&P has four coal-fired units operating and another under construction. In an attempt to diversify fuel types to reduce the possibility of fuel curtailment due to rail strikes and because of the high rail tariffs currently being imposed on coal shippers, western coal was not selected as the primary fuel alternative for this project.

4.3.7 Nuclear

HL&P is currently participating in a two-unit nuclear project in Matagorda County, Texas. In an attempt to diversify fuel types and due to the considerably longer lead time associated with planning, design, licensing and construction of a nuclear project in today's environment, nuclear was not selected as the primary alternative for this project.

4.3.8 Biomass

Biomass can become a significant U. S. energy resource. With foreseeable technologies and economies, up to five percent of the fossil fuels now consumed in the United States could be replaced by available forestry, agricultural and municipal wastes and residues (Benemann, 1978). However, fundamental limitations imposed by the size of the biomass resource, the costs associated with biofuel transport, and the difficulty of ensuring availability for extended periods tend to limit the use of biomass directly for electric power production (Bos, 1980). For these reasons, biomass was not considered as a viable alternative fuel for the proposed Malakoff EGS.

4.3.9 Lignite

Lignite is a soft brown coal found in great abundance in Texas. The Bureau of Economic Geology estimates that a total of 9.46 billion metric tons (10.4 billion tons) of recoverable, near-surface lignite occurs within the state. Earliest use of lignite as a fuel source for the production of electrical energy occurred at the Trinidad Power Plant more than 50 years ago. Because of a plentiful supply and low cost of natural gas in the area, the Trinidad Power Plant was later converted to natural gas. However, with rising natural gas and fuel oil prices, electric utilities once again began to consider lignite as an alternative fuel. The first large scale lignite plant in recent years began operation in 1954 near Rockdale, Texas. In 1972, the Big Brown plant began operation. Since that time, Monticello and Martin Lake have become operational. Many other lignite-fueled power plants are under construction or are in the planning and design phases.

The availability and relatively low cost of lignite, the desire on the part of utilities for fuel diversification, the mandates of the FUA, the political entanglement of nuclear licensing, and the high transportation costs of western coal have all contributed to utilities consideration of lignite as a fuel source for baseload power generation. For these reasons, HL&P has selected Texas lignite as the preferred fuel for the proposed Malakoff EGS.

4.4 DESIGN AND SITING OPTIONS FOR THE CONSTRUCTION AND OPERATION OF THE PROPOSED GENERATING STATION, TRANSMISSION LINES, WATER PIPELINE, LIGNITE CONVEYANCE FACILITIES AND MINE

4.4.1 Power Station Siting Options and Design Alternatives

4.4.1.1 Siting Options

The site selection process was initiated in February 1979, when HL&P formed a task force to coordinate preparation of a site selection study. The primary objectives of the siting study were as follows:

1) Select a study region, within which it would be economically feasible to transport lignite from reserves jointly controlled by The North American Coal Corporation and Getty Oil Company;

2) Screen the study region to identify candidate areas that would contain potential sites which are considered licensable under the then current regulatory restrictions;

3) Identify candidate sites for a lignite-fired steam-electric power station within the candidate area; and

4) Designate a prime site having high environmental and economic acceptability for a nominal two-unit lignite-fired steam-electric power station.

The site selection process included regulatory requirements, and engineering and economic parameters.

Specifically, a study region was first selected to include those areas within which it would be economically feasible to transport lignite from the deposits to the generating station. This choice of study region yielded a region comprising lands within approximately a 32-km (20-mi) perimeter of the leased lignite deposits (approximately 5,376 km^2 (2,100 mi^2)). Next, a set of criteria, or screening factors, was developed for use in ultimately selecting the site. These regional screening factors included geology, air quality, meteorology, hydrology, water quality, ecology, land use, aesthetics, noise and socioeconomics. These factors, along with licensing and economic and engineering considerations, were used to identify areas which should be excluded from further consideration. Examples of areas excluded are:

1) National Forests

2) National Parks

3) Wilderness Areas

4) Wildlife Refuges (State and Federal)

5) Historic and Archaeological Sites Listed on, or Nominated to, the National Register of Historic Places

6) State Parks and Recreation Areas

7) Game Preserves

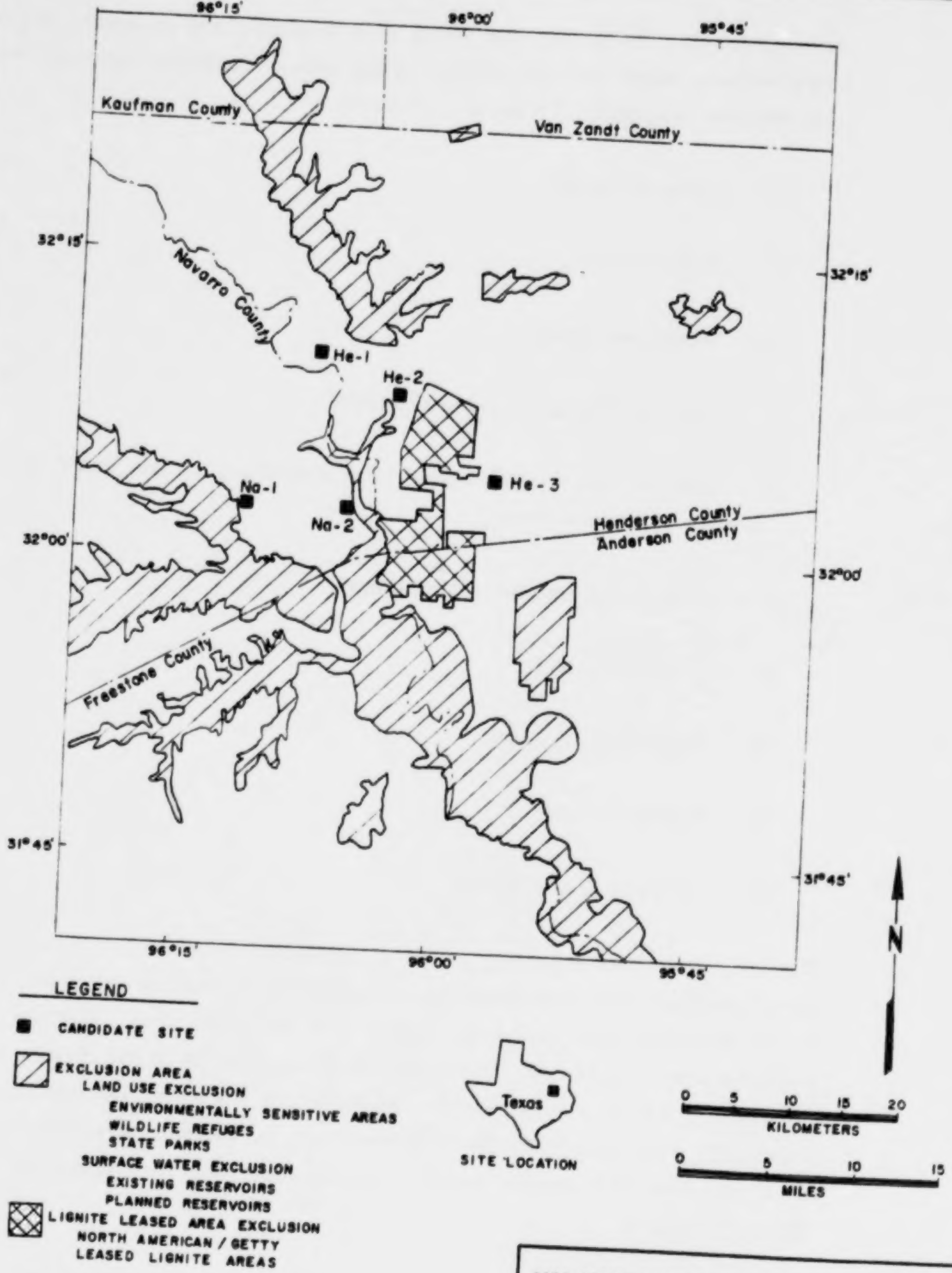
8) State Hunting Lands

9) Primitive Areas

10) Wild and Scenic Rivers

The remaining areas were designated as candidate areas. Within the candidate areas, a set of candidate sites was identified. It is emphasized that by definition, sites identified in the candidate area region are expected to be viable sites. Further, more detailed evaluations were conducted for the purpose of verification of the absence of specific site anomolies and to determine relative ranking among the sites. The factors used in ranking these sites were essentially those factors used for regional screening, except that the sites were studied in greater detail. Five candidate sites were identified. Locations are shown in Fig. 4-1.

Site Rankings. Economic rankings of candidate sites were performed using a computerized economic comparison model. The sites were compared by determining the


96°15'
96°00'
95°45'
32°15'
32°00'
31°45'
Kaufman County
Van Zandt County
Navarro County
Henderson County
Anderson County
Freestone County
He-1
He-2
He-3
Na-1
Na-2
N
LEGEND
■ CANDIDATE SITE
EXCLUSION AREA
LAND USE EXCLUSION
ENVIRONMENTALLY SENSITIVE AREAS
WILDLIFE REFUGES
STATE PARKS
SURFACE WATER EXCLUSION
EXISTING RESERVOIRS
PLANNED RESERVOIRS
LIGNITE LEASED AREA EXCLUSION
NORTH AMERICAN / GETTY
LEASED LIGNITE AREAS
Texas
SITE LOCATION
0 5 10 15 20
KILOMETERS
0 5 10 15
MILES

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-1

CANDIDATE SITES

Source: TERA Corporation, 1980

differential unit cost (per kilowatt hour) of energy delivered for the specified plant output. The major candidate site cost differentials were determined by combining the cost elements for the heat dissipation system, water transport system, lignite transportation facilities and site development requirements in a single present value for each site as of the date of operation. Costs for construction and operating outlays for the above plant systems, which can be significantly influenced by site location, were evaluated. Environmental and licensing considerations for the candidate sites were also evaluated, and overall rankings for each site were established. A summary of the economic, environmental and overall rankings is presented below:

Site	Economic Ranking	Environmental/ Licensing Ranking	Overall Ranking
He-2	1	2	1
He-1	3	1	2
He-3	2	3	3
Na-1	4	5	4
Na-2	5	4	5

The site rankings were developed by using both quantitative and qualitative evaluation methods to rate each candidate site based upon the factors described earlier. The qualitative assessment provides a means for rating the intangible or nonquantifiable features of each site. The quantitative assessment is primarily a numerical evaluation of economic, environmental and licensing evaluation factors. For each of the factors, an evaluation is made of relevant characteristics to establish the appropriate numerical rating.

Of the five sites compared, He-2 was found to be the most economical site, followed by He-3. From an environmental and licensing standpoint, He-1 was ranked first, and He-2 second. However, the combined ratings showed He-2 to be first overall, with He-1 second, He-3 third, Na-1 fourth, and Na-2 fifth.

Sensitivity analyses were performed on both the economic, environmental and licensing evaluations to determine if any factors needed additional consideration or evaluation. These analyses showed that for logical changes in evaluation factors, He-2 and He-1 reverse their relative positions when changes occur in the relative importance of environmental, licensing and the socioeconomic weighting factors. The results of an analysis of the consequences of varying the economic weighting factor relative to the total environmental and licensing weighting factor over the range of all feasible values indicated that site He-2 remains the highest ranked site for the majority of feasible combinations of weighting factors. However, because the site rankings exhibited sensitivity to the socioeconomic parameter, a more detailed evaluation of this consideration was undertaken.

Although the He-2 site is located near the City of Malakoff, existing land use between the site and the city includes a segment of the St. Louis-Southwestern railroad, the Malakoff municipal waste treatment facility, a brick factory and associated clay pits. Residential and recreational development pressures in the vicinity of Malakoff are occuring north and northwest of the city in the direction of Cedar Creek Reservoir, while the proposed site is located southwest of Malakoff. The main plant area will be sufficiently removed from Malakoff (approximately 4.8 km (3 mi)) so that a buffer will exist between the city and plant construction and operational effects.

The He-1 site, located approximately 9.6 km (6 mi) west of Malakoff, was ranked slightly higher in terms of environmental considerations than the He-2 site. However, the He-1 site is located closer to Cedar Creek Reservoir, and is felt to actually represent a greater potential for socioeconomic impact during the life of the plant as a result of residential and recreational development in the vicinity of the reservoir. The environmental rankings alone were not specifically designed to reflect this distinction between the two sites, but based on the more detailed investigation resulting from the sensitivity analyses, the ranking of He-2 as the prime site was re-emphasized.

4.4.1.2 Alternative Station Designs

Cooling System Alternatives.

Circulating Water System. Waste heat generated during plant operation is transferred from the steam to cooling water in the condenser in the circulating water cooling system. The cooling water may be circulated on a once-through basis or recycled through a closed-loop system after being cooled in a cooling tower, spray pond or cooling pond.

Once-through cooling removes waste heat by pumping cooling water from an intake source through the condenser and discharging it at a higher temperature. This type of cooling requires a source of water capable of continuously supplying over 28 m^3/sec (1,000 ft^3/sec) for a two-unit site. The source should be near the site to minimize the costs of pumping this high volume of water. Water availability and site location make once-through cooling impractical for the Malakoff EGS.

Cooling ponds reject waste heat from cooling water through natural evaporation. The cooled water is pumped from the pond to the condenser for reuse. Approximately 0.41 ha (1 ac) of pond surface per megawatt of generating capacity is normally required. Two 600-MW units would require a 574-ha (1,400-ac) pond to dissipate waste heat. This large land requirement makes a cooling pond impractical as a cooling alternative for this site.

Spray ponds dissipate waste heat by discharging the heated cooling water through a series of spray nozzles located in a pond or canal. Cooling is limited by the relatively short period of contact between the spray and the air. The cooled water is pumped back to the condenser for reuse. The canal size is considerable, though smaller than a cooling pond for comparable service due to the increased heat transfer provided by the spray nozzles. However, high capital costs for pond development, pumps and distribution piping make spray cooling impractical.

Cooling towers are the most common cooling alternative used in closed-loop circulating water systems. Heat transfer can be by evaporative and/or sensible means, depending on tower type. Cooling water from the condenser enters the tower where it is air cooled and recirculated to the condenser. Cooling towers require significantly less land than spray canals, spray ponds or cooling ponds, and have a widely accepted record. The available types of cooling towers are discussed in the following section.

Alternative Cooling Towers. Cooling towers for closed-loop cooling systems can be either dry, wet or wet/dry. In dry towers, cooling is accomplished solely by sensible heat transfer using air as the cooling medium. A wet tower employs air as the cooling medium and dissipates heat through evaporation of water and, to a lesser extent, through sensible heat transfer directly to the air. Wet/dry towers combine the features of both.

Dry Cooling Towers. Dry cooling towers, whose air flow may be induced by natural or mechanical means, are generally classified as either direct or indirect. A direct system passes turbine exhaust steam through finned tubes contained in the cooling tower. This eliminates the need for the power plant condenser. An indirect system employs a condenser and passes the heated circulating water through the tower in order to accomplish the required cooling. Both types are closed to the atmosphere so that no air to water interface exists. As a result, evaporation does not take place, and consumptive water use is limited to leakage from the system. Cooling is accomplished solely by sensible heat transfer.

In prohibiting evaporative heat transfer, this system sacrifices the ability to cool circulating water (or steam) to approach the ambient wet bulb temperature. A dry tower can cool circulating water no lower than the ambient dry bulb temperature, and towers which closely approach it can be prohibitively expensive. Circulating water temperature directly affects the steam condensing temperature, and therefore, the resulting turbine back pressure. Inability to cool beyond the dry bulb temperature may result in back pressures which exceed design criteria, resulting in a decreased generating capacity. Dry towers have been limited to plants with generating capacities of 350 MW or less. Dry towers to service larger generating plants would require such a large surface area for cooling that the costs for the installation would be prohibitive.

Wet Cooling Towers. Wet towers can be either mechanical-draft or natural-draft. In both systems, cooling water is brought in direct contact with air. Heated cooling water from the condenser falls downward in the cooling tower fill section while air passes through. As the air passes, a small percentage of the water is evaporated, cooling the balance of the water. A small portion of the cooling water must be removed as blowdown and replaced with fresh water to maintain suitable solids concentrations in the circulating water system. Evaporation and blowdown losses account for two to five percent of the circulating water flow.

Wet/Dry Cooling Towers. Wet/dry towers combine evaporative and sensible heat transfer by drawing ambient air in parallel paths through a dry air-cooled section of the tower and through a wet evaporative section. During periods of high air temperature, only wet cooling is used; otherwise, design back pressures are exceeded. When temperatures are low, the dual cooling reduces the evaporative losses which occur during all-wet cooling. Dual cooling produces a less visible effluent plume than all-wet cooling, since the saturation level of the effluent is reduced. The major disadvantage to wet/dry towers is their high capital costs.

Evaluation of Alternative Cooling Towers. Dry cooling towers have virtually no blowdown or evaporation, and makeup water is needed only to replace system leakage.

Their primary impact is an increase in dry bulb air temperature at the exit point of the tower. Noise from fans and motors will contribute to area sound levels.

The operation of wet towers results in the release of warm saturated air from the evaporative process. Cooling tower drift is the release of water droplets entrained in the air used for evaporation. The release of warm saturated air can result in fog under some meteorological conditions. Drift deposition can cause corrosion or icing of nearby structures and can modify soil chemistry and impact vegetation. Deposition is confined mostly to the plant area. Fogging impact will be negligible.

Wet/dry towers incorporate both wet and dry cooling methods; therefore, atmospheric impacts associated with wet towers can be reduced and annual makeup water consumption decreased. Plume abatement is achieved by producing an unsaturated exhaust which will not readily condense when mixed with ambient air. The tower would have a large evaporative section relative to the dry cooling section. Maximum summer makeup water requirements would not be significantly different from totally wet towers. However, annual water consumption would be reduced in a wet/dry tower with the dry section operating more frequently than the wet section. Annual makeup water requirements can range from 5 percent to 40 percent of a totally wet tower, depending on the relative proportion of the wet cooling section in the wet/dry tower. Noise from fans and falling water will contribute to area sound levels.

Sufficient makeup water is available to the site for the implementation of wet evaporative towers. Dry cooling towers and wet/dry towers are substantially higher in cost than wet towers. Reduced water consumption and plume abatement, which are generally associated with dry cooling towers and wet/dry towers, do not justify their higher costs.

Wet evaporative towers are preferred for the site based on economics and engineering feasibility. These towers can provide the cooling capacity required for the station at minimum cost for a technically feasible alternative with minimal environmental impact.

Biological Control Alternatives. Treated sanitary wastewater is the only wastewater containing chlorine normally released off site. Each of the alternative biocide systems has the same environmental impact, therefore, the preferred system was selected on the basis of most effective biocidal performance at lowest cost.

Gaseous chlorination and on-site hypochlorite generation are two alternatives which provide effective control of biological growth, have been demonstrated to be effective at similar installations, and have relatively similar costs. There is no normal discharge of cooling tower blowdown containing residual chlorine; hence, the environmental impact of each alternative is minimal and not a factor in equipment selection. Based on a lower capital cost for installed equipment with minimal environmental impact, the gaseous chlorination system has been selected.

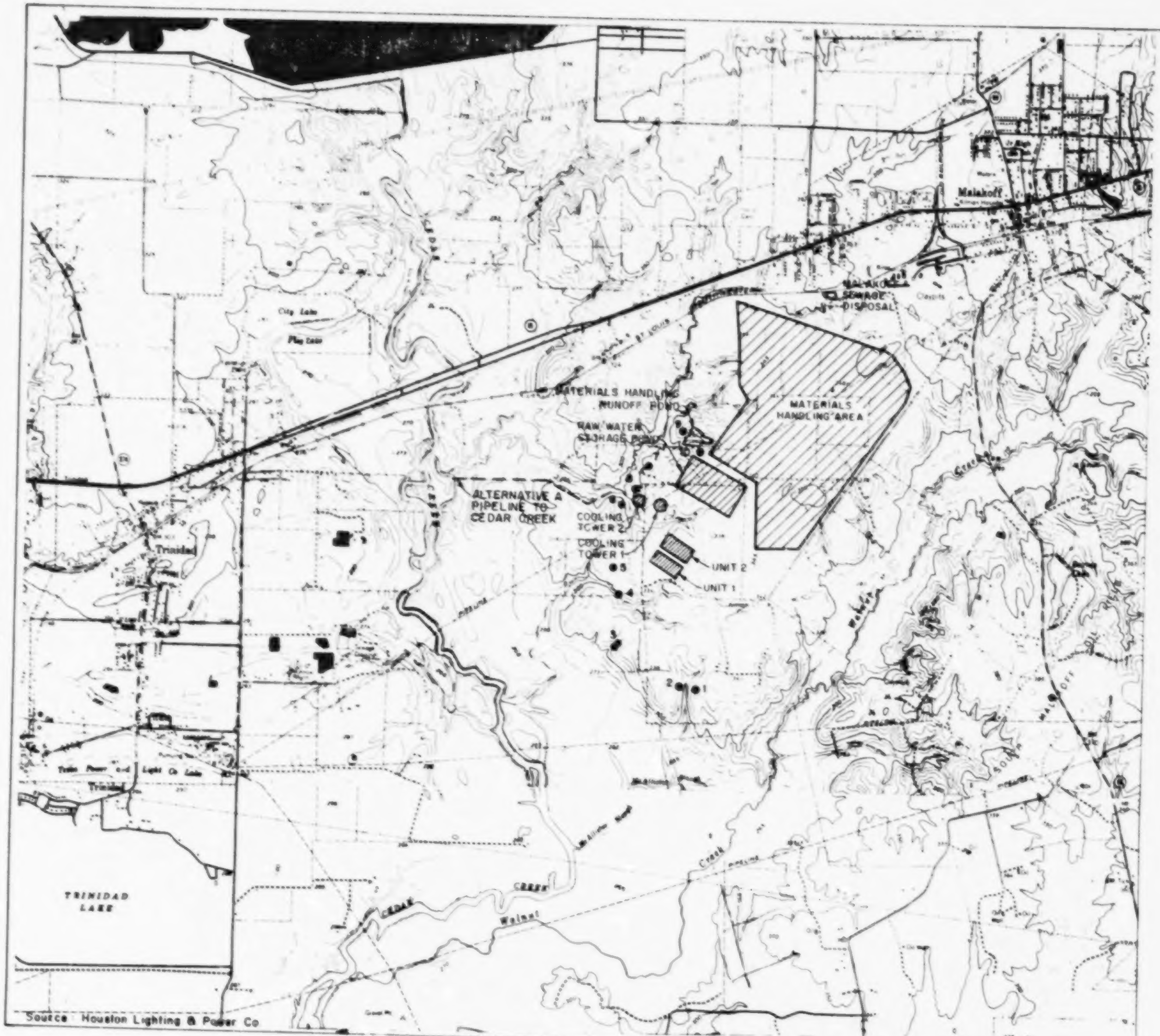
Plant Discharge System Alternatives. Wastewater from plant operation is reused in water systems, where feasible, based on engineering and economic considerations. The following wastewater flows are discharged off site:

	Average Flow		Maximum Instantaneous Flow	
	liters/sec	(gpm)	liters/sec	(gpm)
Treated Floor Drainage	11.36	180	23.97	380
Treated Sanitary Wastewater	1.26	20	6.31	100
Lignite Pile Runoff	4.42	70	31.55	500
Inorganic Metal Cleaning Waste	2.84	45	9.46	150
Chemical Waste	3.79	60	7.57	120
Materials Handling Area Runoff	6.31	100	410.09	6,500
	29.98	475	488.95	7,750

Engineering Features. Two alternatives were evaluated to convey plant discharge off site. These alternatives are described in Fig. 4-2. Alternative A is a 1,524-m (5,000-ft) buried pipeline to a tributary of Cedar Creek. The pipe would convey all wastewater from a common on-site collection pond to a single discharge point. The outlet structure in the Cedar Creek tributary is designed with retaining walls and energy dissipators to discharge the flow into the tributary smoothly. The tributary would be widened and the banks stabilized in the immediate area of the outlet structure.

Alternative B considers the release from each particular wastewater source into the plant yard drain system, which conveys the wastewater to the nearest natural drainage pathway. Multiple yard drain piping termination points are required as described in Fig. 4-2. Outlet structures are designed at each termination point with retaining walls and energy dissipators to smoothly discharge flows into the drainage channels. Channels would be widened and banks stabilized in the immediate area of the outlet structures.

Economic Features. Table 4-1 compares the capital cost (1987) and Present Worth of Revenue Requirement (PWRR) of the two discharge alternatives. Alternative B, the use


Malakoff
MALAKOFF SEWAGE DISPOSAL
MATERIALS HANDLING AREA
MATERIALS HANDLING RUNOFF POND
RAW WATER STORAGE POND
ALTERNATIVE A PIPELINE TO CEDAR CREEK
COOLING TOWER 2
COOLING TOWER 1
UNIT 2
UNIT 1
City Lake
Trinidad
TRINIDAD LAKE
CEDAR CREEK
Walnut Creek
1
2
4
5
N

Source Houston Lighting & Power Co

LEGEND

● .LEASE POINTS

LIST OF RELEASE POINT COORDINATES

1	N 172,850 E 2,451,500	STORMWATER
2	N 172,850 E 2,451,450	STORMWATER
3	N 173,750 E 2,449,250	STORMWATER
4	N 175,850 E 2,449,150	STORMWATER - TREATED WASTEWATER
5	N 176,500 E 2,448,500	STORMWATER
6	N 176,000 E 2,449,100	STORMWATER
7	N 178,350 E 2,450,350	STORMWATER
1	N 178,100 E 2,449,350	STORMWATER
9	N 179,150 E 2,451,150	TREATED MATERIALS HANDLING AREA RUNOFF
10	N 179,200 E 2,451,500	STORMWATER

0 500 1000
Meters
0 2000 4000
Feet

SOURCE HOUSTON LIGHTING & POWER CO.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-2

PLANT DISCHARGE SYSTEM ALTERNATIVES

Reproduced from best available copy.

TABLE 4-1

ECONOMIC COMPARISON OF PLANT DISCHARGE SYSTEMS

	Alternative A Pipeline to Cedar Creek	Alternative B Discharge to Natural Drainage
Capital Costs (1987)	$ 620,650	$ 53,800
Capital Costs (PWRR)	1,232,000	106,800
Output Penalty (PWRR)	0	0
Fuel Costs	0	0
Total Cost (PWRR)	$1,958,900	$169,800
Differential	$1,789,100	Base

of multiple natural drainage channels near the site which drain into Cedar Creek, has the lower evaluated total cost for a technically feasible alternative. PWRR differentials for alternative A are $1,789,100.

Environmental Features. Alternative A, a pipeline to Cedar Creek, requires modification of a small tributary of Cedar Creek. The tributary would be widened and the bank stabilized in the area of discharge. Alternative B, multiple discharges to the plant yard drain system releasing water to near-site drainage channels, requires modification of each of the drainage channels in the area of discharge. The channels would be widened and the banks stabilized. Continuous flow might occur in channels that were historically intermittent.

Each alternative affects a narrow corridor of vegetation along its route, particularly during construction.

Based on the engineering features of each alternative, the cost comparison, and the minimal environmental effects of either alternative, releases into the yard drain system is the preferred discharge design alternative.

Liquid Waste Management System Alternatives. The alternative liquid waste management system evaluated for the plant utilizes the 29.97 liters/sec (475 gpm) to be discharged off site, providing a zero discharge system design. This 29.97 liters/sec (475 gpm) wastewater flow consists of 11.36 liters/sec (180 gpm) treated oil wastes, 11.04 liters/sec (175 gpm) of treated wastewater from the low volume waste, chemical waste, lignite pile runoff waste and inorganic metal cleaning waste treatment systems, 6.31 liters/sec (100 gpm) of materials handling area runoff, and 1.26 liters/sec (20 gpm) of sanitary wastewater.

In the alternative system, treated wastewater and treated oily waste flow of 29.97 liters/sec (475 gpm) are used in the FGD system, providing a zero discharge plant. To utilize the total off-site discharge flow in the FGD system, FGD makeup from the main circulating water system must be reduced. Reducing the circulating water system blowdown requires an increase of the cycles of concentration in the circulating water system from approximately 7 to 10. Operation of the circulating water system at 10 rather than 7 cycles of concentration poses a greater potential for plant operating problems, due to the increase in plant complexity and the closer control required for system chemistry. Some operational problems are:

1) The increased total dissolved solids in condenser cooling water at 10 cycles of concentration would increase resin consumption in the condensate polisher system, should condenser leaks occur.

2) Operating the circulating water system near the predicted scaling threshold increases the potential for scaling of condenser heat transfer surfaces, should makeup water quality change or lime-soda softening effluent quality fluctuate widely.

3) Extra treatment equipment increases plant complexity, due to the attention which must be given to softening chemistry and additional sludge handling.

Treated demineralizer regeneration wastes and metal cleaning wastes contain a high concentration of chlorides, which is undesirable in the FGD system. An evaporator must be included in the design of the zero discharge system to reduce Chlorides to an acceptable concentration for reuse in station water systems. An evaporation pond is also required to solidify the highly concentrated salts from the evaporator bottoms.

Due to the increased complexity of plant operation, resulting from the addition of sidestream treatment and evaporation equipment, and to the close control which would be required on water balance and water chemistry, the zero discharge system has not been selected for use at this site.

Solid Waste Management System Alternatives. This section presents a discussion of the alternative solid waste handling and disposal practices that were considered for the Malakoff EGS. Bottom ash (including pyrites), fly ash and FGD sludge constitute the majority of the station solid wastes and are the wastes for which alternative handling systems were considered.

Bottom Ash and Pyrites. Two methods were considered for handling bottom ash and pyrites. The ash collection system for each alternative is similar, as described in Sec. 4.5.1.7. The alternative handling techniques differ only in the method for separation of the ash from the water which is used for ash collection and transportation. A dry management bottom ash handling system employs hydrobins for settling bottom ash from sluice water. Supernatant from the hydrobins is clarified for removal of suspended solids and returned to the bottom ash system for reuse. The settled ash is trucked from the hydrobins to the solid waste disposal area for disposal with the combined FGD sludge and fly ash in lined cells.

A wet management bottom ash handling system employs a lined settling pond for the separation of bottom ash from the transport water. The settled bottom ash is removed from the ponds and trucked to the materials handling area. Water from the bottom ash pond is reused in the bottom ash system.

Handling of bottom ash in the wet management system requires a commitment of approximately 2.05 to 4.1 ha (5 to 10 ac) more land than in the dry management system. The bottom ash settling pond is required, in addition to the landfill area used for the disposal of bottom ash and combined fly ash and FGD sludge. The transfer of bottom ash from ponds into trucks increases the handling of bottom ash and results in higher operational costs for the wet management system.

The dry management system has several advantages over the wet system. Staged disposal in individual cells within the materials handling area minimizes the active disposal area and offers greater flexibility for accommodating operational regulatory changes. Additionally, the wet handling system is projected to consume more water than the dry system because of the evaporation associated with the bottom ash pond.

Since, under proper management, the environmental impacts of either alternative are negligible, the dry management system has been selected due to the greater land requirements and operational costs of the wet management system.

Fly Ash and FGD Sludge. Fly ash collected from the electrostatic precipitator can be handled either wet or dry. In either case, it is collected dry at the precipitator hoppers. A wet transport system employs water to transport the collected ash to an ash storage pond.

A dry fly ash system does not consume fresh water nor does it require land needed for settling and storage ponds. The fly ash is pneumatically conveyed to the ash storage silo. The dry system is more flexible in that ash can be sold, mixed with FGD sludge for stabilization, or discharged into closed trucks for dustless removal. Since the dry system consumes no water, provides a material which is suitable for stabilization of FGD sludges, and requires no commitment of land for settling ponds, the dry system has been selected.

FGD sludge can be disposed of either separately or combined with fly ash. The advantages of combining or stabilizing FGD sludge and fly ash prior to disposal are:

1) The land committed to solid waste disposal is reduced.

2) The permeability of the stabilized waste is less than the average permeability of the separate wastes. The potential for leachate production and possible groundwater contamination is thereby reduced.

3) A disposal operation for one material, rather than two, is required. This reduces the complexity of sludge transfer, spreading and compaction.

There would be an advantage to separate disposal if an SO_2 removal system was selected that produced solid by-products which could be reused. Sulfuric acid, elemental sulfur and gypsum can be produced from various SO_2 scrubbing processes. Production of by-products would reduce the volume of sludge requiring on-site disposal. However, the production of a commercial grade gypsum or a sulfur/sulfuric acid by-product has many technical and commercial considerations which limit its use. These considerations are:

1) Limited market demand.
2) By-product quality control.
3) By-product transportation and storage costs.
4) Limited utility experience.
5) Capital and operating cost impacts due to process design changes.

For the above reasons, no modification to the scrubber process to produce by-products for resale was given further consideration for this plant. On-site disposal of FGD sludge, bottom ash and fly ash will be used.

Alternative Material Handling Systems. Four alternatives for the ultimate disposal of the plant solid wastes were considered:

1) Dewatering FGD sludge for combination with fly ash, resulting in a soil-like material which can be placed and compacted in a landfill. Bottom ash is dewatered and sandwiched in the landfill with the stabilized sludge.

2) Disposal of the sludge in the nearby lignite mine using the same treatment as described in the above alternative.

3) Mixing FGD slurry (unoxidized and not dewatered) with fly ash and bottom ash and pumping the combined mixture to a pond.

4) Pumping oxidized FGD sludge (gypsum) to a pond with separate landfill of bottom ash and fly ash.

Both pond and landfill disposal alternatives can be accommodated using approximately 215.25 ha (525 ac) of available land adjacent to the plant. Both the landfill and mine disposal alternatives require the mixing of fly ash and dewatered FGD sludge in pug mills and transportation of the combined solids to the disposal area, either on site or at the mine. The pond disposal alternative for unoxidized FGD sludge assumes the mixing of bottom ash, fly ash and unoxidized FGD sludge (not dewatered) and the pumping of the combined waste to three 71.75-ha (175-ac) on-site ponds. The pond alternative for gypsum assumes the pumping of oxidized FGD sludge (not dewatered) to five 20.09-ha (49-ac) ponds, with transportation of fly ash and bottom ash to a 114.8-ha (280-ac) landfill.

Mine Disposal. Mine disposal poses a greater ground-water infiltration potential than landfill disposal. The working depth of the mine is expected to be approximately 27.4 m (90 ft) while the ground-water elevation in the area ranges from 4.6 to 12.2 m (15 to 40 ft) below grade. During operation of the mine, the ground-water elevation is kept below the working level of the mine by dewatering pumps. At the end of the useful life of the mine, the pumping operation will be terminated, and ground water will eventually return to near its original elevation. Consequently, ground water is expected to continuously contact emplaced sludge, increasing the potential for leaching of chemical constituents. A liner and a lechate collection system are not practicable for mine disposal due to the elevation of the ground-water table.

In both the mine disposal and landfill options, the sludge is combined in the pug mill and has a consistency similar to moist soil. This reduces the probability of dust production during the transportation and placement operations.

The process of removing lignite from and placing sludge into the mining area simultaneously has some impact on the efficiency of the mining operation, since additional traffic congestion would be created both by the continuous movement of 15 sludge-carrying trucks daily and by the heavy equipment used to place and compact the sludge. Due to the unknowns concerning contamination of ground water and impairment of mining efficiency, mine disposal was eliminated from further consideration.

Pond Disposal. Disposal in settling ponds is the most expensive alternative. Settling ponds would modify the topography of the site area significantly. The potential for ground-water contamination is greater for the disposal pond than for the landfill since a continuous hydraulic head is maintained on the liner by the pond, providing a driving force for water to permeate the liner. This increases the potential for leaching heavy metals from the sludge. To control the leachate, the pond is equipped with a leachate collection system for ground-water protection.

Upon decommissioning of the plant, the ponded sludge may not be sufficiently stabilized to allow reclamation of the pond area. The mixed ash and FGD sludge could still have thixotropic tendencies, and consequently, no load bearing capacity.

The settling pond also consumes in excess of 567.75 million liters (150 million gal) of water per year more than the other alternatives. This is due to the more dilute concentration of the emplaced sludge and surface evaporation from the pond. Since combined sludge is handled wet in the pond, the potential for dust production from the disposal pond is negligible.

Gypsum Pond and Ash Landfill Disposal. Disposal of gypsum in settling ponds requires dikes approximately 16.8 m (55 ft) high, enclosing five 20.09-ha (49-ac) ponds. Less space is required for the gypsum ponds than for the unoxidized FGD sludge ponds due to the more effective dewatering which can be achieved with the gypsum sludge and the separate disposal of ash. The potential for ground-water pollution is less than with the unoxidized FGD sludge, since bottom ash and fly ash are segregated in a landfill. However, a compacted clay liner with leachate collection system is provided to control potential ground-water pollution from the gypsum pond.

The gypsum pond is similar to the unoxidized FGD sludge pond with regard to water consumption and sludge production. Some uncertainty also exists as to the potential success of gypsum pond reclamation, since the structural stability of ponded gypsum has not been demonstrated.

Over the 35-year life of the plant, the ash landfill operation would result in a 114.8-ha (280-ac) landfill, 35.1 to 36.6 m (115 to 120 ft) high. The landfill would be developed in annual 3.28-ha (8-ac) cells that would utilize a 0.91-m (3-ft) clay liner to protect the ground water from heavy metals leaching from the landfill.

Landfill. The potential for ground-water pollution by leachate from the landfill is reduced by the stabilization process and by compaction at the landfill. Although initial test cells will be clay-lined, a compacted clay liner should prove unnecessary for the landfill alternative. The permeability of stabilized sludge closely approaches the obtainable permeability of a compacted clay liner. A properly operated stabilized sludge landfill should have little or no leachate due to the low permeability of the stablized sludge.

The change in topography resulting from the landfill operation is less than that resulting from ponding, with the height of the fill being approximately 28.35 m (93 ft) above grade after plant decommissioning.

The active portion of the landfill will be minimized to limit the amount of contaminated runoff and fugitive dust from the drying sludge surface. Covering with topsoil and revegetation in a staged manner further minimizes runoff and controls erosion. Wetting of roads to and in the disposal area during dry months will be conducted, if necessary, to minimize dust production from sludge transportation.

Mechanical dewatering of FGD sludge before stabilization and subsequent landfill conserves 567.75 million liters (150 million gal) of water per year in comparison to ponding of the combined wastes.

The landfill alternative was selected for the plant because this design provides the most protection against potential ground-water contamination and is less expensive than ponding of either gypsum or unoxidized FGD sludge.

Sanitary Waste Treatment System Alternatives. The two methods of sanitary wastewater treatment being considered for the Malakoff EGS are on-site biological treatment using a prefabricated treatment package and off-site disposal in the local Malakoff municipal wastewater package treatment.

On-site Treatment. During normal operation, sanitary wastes average approximately 1.26 liters/sec (20 gpm), based on a plant staff of 650 using 132.48 liters (35 gal)/capita per day. During construction, a daily maximum of 2,500 people will use both a central toilet facility and portable toilets located in outlying areas of the site. In the case of on-site treatment, the central toilet facility would drain by gravity to an equalization tank, from which the wastewater would be pumped to a prefabricated activated sludge-type sewage treatment plant which includes chlorination.

Wastes from the portable toilets would be trucked to the equalization tank, where water is added to dilute the wastewater before treatment. The construction staff uses an estimated 94.63 liters (25 gal)/capita per day, producing an average flow of 2.52 liters/sec (40 gpm).

Off-site Disposal. The Malakoff municipal plant, constructed in 1978, uses an extended aeration biological treatment ("rail track" oxidation ditch process). It has a maximum design capacity of 3.03 million liters/day (0.8 MGD). The discharge standards for biochemical oxygen demand (BOD) and suspended solids are 20 mg/l daily average. The present average flow is 0.715 million liters/day (0.189 MGD). To tie in with the Malakoff plant, a fully-equipped, duplex sewage lift station would be provided, including transfer pumps, ventilation, piping and controls. Approximately 3.22 km (2 mi) of a force main would be laid between the site and the Malakoff wastewater treatment plant, since the elevations of the site and the treatment plant are virtually identical. This is currently the applicant's preferred alternative.

Alternative Air Quality Control Systems. There are several commercially available systems capable of achieving compliance with the particulate and sulfur dioxide (SO_2) emission limits for the plant.

Particulate Removal. Electrostatic precipitators (ESPs) and fabric filters are commercially proven systems capable of achieving particulate control to comply with EPA's New Source Performance Standards (NSPSs) for electric utility generating units greater than 73,200 kW (250 MBTU/hr) (heat input).

Precipitator. Electrostatic precipitators use an array of parallel grounded plates (the collecting electrodes) and discharge electrodes mounted in a plane midway between the plates to induce a static charge upon the particulate matter. The particles are charged by the electrical field created between the discharge and collecting electrodes. Particulate matter collects on the plates and is dislodged by rapping. Dislodged particles fall into an ash storage hopper for subsequent removal and disposal. Fly ash disposal is discussed in Sec. 4.5.1.7.

A precipitator is designed either "hot-side" or "cold side" depending upon its location in the flue gas stream in relation to the air preheater. A cold-side precipitator is located downstream of the air preheater, a location which reduces thermal losses thereby increasing unit efficiency.

In a hot-side application, the precipitator is placed in the gas stream between the boiler and air preheater. The higher temperature at this location improves collection efficiency, allowing the use of a smaller precipitator. However, the flue gas temperature decrease through the precipitator reduces the unit's thermal efficiency, resulting in increased fuel consumption. A hot-side ESP also requires more extensive secondary air ductwork since the air heater is relocated further from the boiler. Additional insulation must be used since it is critical that temperature loss be minimized. Performance and operating problems have occurred at some plants due to the structural and control problems related to high temperature operation. Higher temperature operation requires a more extensive structural design.

Fabric Filter. ESPs have been the most commonly used particulate collection device in the electric utility industry to comply with State and Federal emission limitations because of their low capital and operating costs. However, increasingly stringent emission standards have permitted fabric filtration techniques to become a competitive alternative in achieving cost-effective standard compliance.

Fabric filters operate by drawing flue gas across a collection medium (most commonly fiberglass) treated with either teflon or silicone-graphite lubricants to minimize abrasion between the layers of fabric fibers. Particulate matter is captured on the surface of the filter or retained within its interstices. Once a mat or cake of dust is accumulated on the fabric surface, further collection is accomplished mostly by sieving. The cloth then serves mainly as a supporting structure for the dust mat. Ash accumulation on the filtering medium requires eventual cleaning of the fabric. This is accomplished by reversing gas flow against the fabric, by shaking the fabric, or by a combination of these methods. Fly ash released from the fabric falls into a hopper for collection and removal from the plant.

Fabric filters operate at higher pressure drops than ESPs, and the filter medium must be replaced at a projected frequency of every two to three years. Pressure drops cause a significant reduction in the flow of flue gas, which causes a reduction in plant electrical generation, increased draft requirements and higher operating costs.

A cold-side ESP was chosen over a hot-side ESP or a fabric filter for the following reasons:

1) Fewer operating problems and less fuel consumption than the hot-side ESP.

2) Better proven performance than fabric filters at plants burning Texas lignite.

3) Greater versatility than fabric filters in meeting varying particulate removal criteria.

Flue Gas Desulfurization. FGD processes are categorized by the final state of the SO_2 absorbent (wet or dry) and the ability of the process to regenerate the SO_2 absorbent for reuse (regenerable or nonregenerable).

Regenerable Removal Systems. In general, regenerable systems are more energy intensive and utilize more complex equipment than nonregenerable systems, resulting in higher costs. The evaluation of regenerable systems is difficult because any advantage in producing a large quantity of a saleable by-product for several decades is difficult to quantify. The advantage of making a saleable by-product is a function of the market conditions for the by-product and such conditions can fluctuate significantly. The operation of a by-product recovery system is a complex chemical processing operation, an operation with which most utilities are unfamilar. This would pose significant problems in the staffing, construction, operation and maintenance of the chemical facility. Two regenerable systems were considered by the applicant: the Wellman-Lord system and the magnesium oxide system.

Nonregenerable Removal Systems. Nonregenerable systems do not reuse the reagent solution and therefore produce larger quantities of waste than regenerable systems. These systems require larger on-site reagent storage facilities and larger disposal areas, but the FGD facilities are generally less complex and require less plant area. Five wet-type nonregenerable systems were considered by the applicant: wet limestone, Chiyoda CT-121, Saarberg-Holter, wet lime and double alkali. The only dry SO_2 removal system considered was the dry lime process. The dry lime process is a nonregenerable system which utilizes two technologies, spray dryers for SO_2 removal and fabric filters for dry lime particulate removal. Electrostatic precipitators may be used in lieu of fabric filters. To date, there is no continuous operating experience for this system in utility application on a scale of 100 MW or larger in the USA.

Cost Evaluation. The four FGD systems for which a detailed economic evaluation was performed are the double alkali, wet limestone, dry lime and wet lime systems. An economic analysis of these systems is presented in Table 4-2 with the wet limestone system as the base case. The SO_2 removal efficiencies of all scrubber systems considered were assumed to be equal, and no credit was given for fluid gas bypass. Economic evaluations were based on differential present worth of revenue requirements.

The analysis indicates that the wet limestone FGD system is a more cost effective SO_2 control device for this application than either the dry lime, wet lime or double alkali systems. This result is primarily due to the differential cost of the lime reagent used in the other systems. On the basis of acceptable technical performance at the lowest evaluated cost, the wet limestone FGD system has been selected for this plant.

4.4.1.3 Alternative Transmission Facilities

As an alternative to building a 320-km (200-mi) long transmission line to the HL&P service area, HL&P sought a point of connection with the existing ERCOT transmission

TABLE 4-2

FGD SYSTEMS DIFFERENTIAL PRESENT WORTH REVENUE REQUIREMENTS (THOUSANDS 1987 DOLLARS)

Present Worth Cost Component	Double Alkali	Wet Lime-stone	Dry Lime	Wet Lime
Installed Capital Costs				
Chemical Reagent Storage/ Handling Section	$ 30,210	Base	$ 36,570	$ 30,210
Absorber Section	Base	$ 31,800	133,000	7,950
Sludge Stabilization Section Emergency Sludge Pond	79,500	82,680	Base	79,500
Initial Spare Parts	Base	5,570	5,960	800
Initial 90-Day Supply of Reagent	8,750	Base	10,180	7,000
FGD Electrical Incremental Power Plant Cost	10,180	18,760	Base	11,450
Subtotal Differential Present Worth for Capital Costs	$128,640	$138,810	$ 185,710	$136,910
Operating Costs				
Manpower	$ 4,350	$ 10,910	Base	$ 4,350
Electricity	22,180	41,500	Base	25,100
Reheat Performance Penalty	5,100	5,100	Base	5,100
Makeup Water	1,800	1,900	Base	1,800
Limestone	Base	278,700	Base	Base
Lime	642,200	Base	$ 891,000	699,000
Soda Ash	160,100	Base	Base	Base
Stabilized Sludge Disposal	Base	2,400	300	Base
Replacement and Repair Allowances	Base	41,200	1,900	4,800
Subtotal Differential Present Worth for Operating Costs	$835,730	$381,710	$ 893,200	$740,150
Total Differential Present Worth Costs	$964,370	$520,520	$1,078,910	$877,060
Base Case Differential Present Worth Costs	$443,850	Base	$ 558,390	$356,540

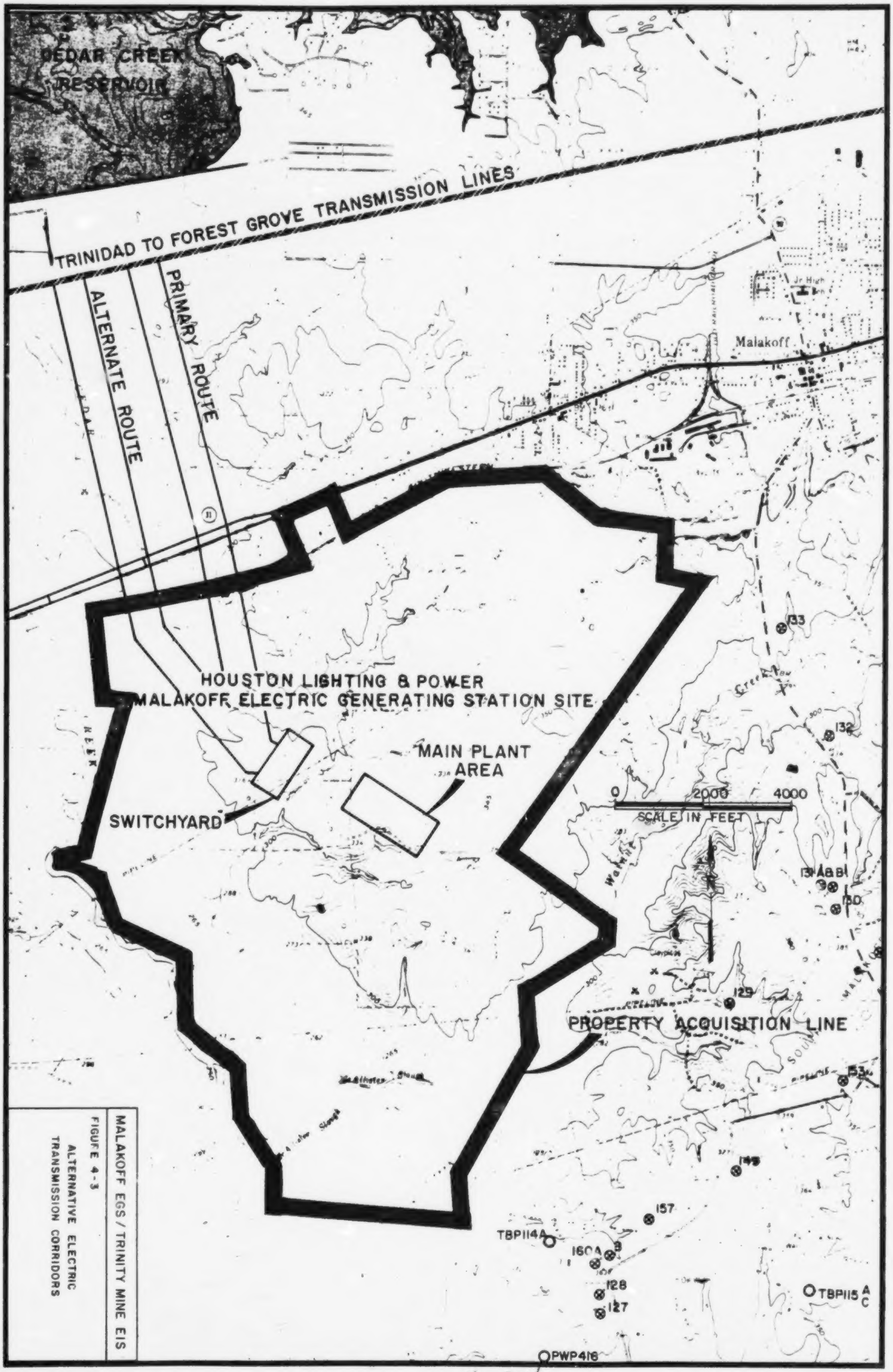
system. The closest transmission tie point to the Malakoff EGS is the proposed TP&L Trinidad-Forest Grove 345 kv transmission lines. Existing right-of-way for these lines runs generally southwest to northeast about 3.7 km (2.3 mi) north of the proposed Malakoff EGS switchyard. Due to the proximity of these facilities, no other tie points were examined in detail; nor was further consideration given to the construction of a 345 kv line from the proposed Malakoff EGS to the existing HL&P transmission grid (approximately 320 km (200 mi) to the south). By minimizing the length of the proposed transmission facilities, both the cost to HL&P customers and the environmental impact associated with construction, maintenance and operation of the facilities were minimized.

Alternative Route Selection. HL&P conducted a routing study to evaluate alternative routes from the Malakoff EGS to the TP&L Trinidad-Forest Grove transmission lines. Initially, a study area was defined. Once the study area was defined, areas considered sensitive were identified and exclusion areas were mapped. Data on sensitive areas were initially obtained from aerial photo interpretation, through contacts with local and state agencies, as well as available publications. Extensive use was also made of comprehensive vegetation, wildlife, land use, hydrology, soils and socioeconomic information collected in support of permitting activities for the Malakoff EGS. During ground-truthing field investigations, additional potentially sensitive areas and/or potential constraints were identified and added to the constraints map.

Following exclusion area mapping, potential corridors were established. Based on the constraints previously identified, two potential corridors were established (Fig. 4-3). Each of the potential corridors was evaluated on the following criteria: 1) scenic areas; 2) archaeological and historical sites; 3) parks and recreation areas; 4) land use; 5) soils; 6) vegetation; 7) wildlife; 8) topography; and 9) hydrology.

Alternative Route Comparison. After review of all physical and cultural environmental criteria, neither of the two routes was determined to contain a significant constraint. Therefore, both routes proved to be an acceptable route for the location of the proposed Malakoff to Trinidad-Forest Grove transmission lines. Even so, it appears that several minor factors tend to favor the eastern-most route. The factors which led HL&P to select the proposed route are discussed in the following paragraphs.

Soils. From a soils standpoint, neither route will affect any soil units classified as prime farmland by the SCS. However, wetness is a potential problem on Gladewater clay


CEDAR CREEK RESERVOIR
TRINIDAD TO FOREST GROVE TRANSMISSION LINES
ALTERNATE ROUTE
PRIMARY ROUTE
Malakoff
Jr High
HOUSTON LIGHTING & POWER
MALAKOFF ELECTRIC GENERATING STATION SITE
MAIN PLANT AREA
SWITCHYARD
0
2000
4000
SCALE IN FEET
PROPERTY ACQUISITION LINE
133
132
131A&B
130
129
153
149
157
TBP114A
160A
B
128
127
TBP115 A C
PWP416

MALAKOFF EGS / TRINITY MINE EIS

FIGURE 4-3

ALTERNATIVE ELECTRIC TRANSMISSION CORRIDORS soils which are the dominant soil type on the western-most route (Alternate Route). Because these soils are frequently flooded, and have low strength and high shrink-swell potential, foundation costs would increase.

Vegetation. From a vegetation standpoint, approximately 1.2 ha (3.1 ac) less of woodlands will require clearing on the "Primary Route" than on the "Alternate Route." This, however, is not considered a significant difference in terms of vegetational communities within the study area. About 4.9 ha (12 ac) less of regulatory wetlands will be affected on the "Primary Route" than on the "Alternate Route." Less damage to herbaceous vegetation, due to movement of men and material along the right-of-way, is anticipated on the drier soils at higher elevations found along the "Primary Route."

Wildlife. Removal of 1.6 ha (4 ac) of bottomland hardwood forests would be required if the "Alternate Route" were selected. The bottomland hardwood areas along Cedar Creek provide excellent wildlife habitat for many species. Again, however, the 1.6-ha (4-ac) differential is not considered significant in terms of available wildlife habitat. But, the "Alternate Route" would require removal of approximately 4.9 ha (12 ac) more of wetland habitat than the "Primary Route."

Land Use. Because neither alternative route will have a significant effect on land use, the only difference is the area to be affected. The acreage required for a 91.4-m (300-ft) right-of-way along the "Primary Route" will contain approximately 1.2 ha (3 ac) less than the "Alternate Route." However, only approximately 0.2 ha (0.5 ac) of this total occurs outside the Malakoff EGS site boundary.

Aesthetics. Because the "Primary Route" is closer to a roadside park and scattered residences than is the "Alternate Route," the degree of visibility of the "Primary Route" will be higher at those existing structures. However, no impairment to aesthetic values in the area is anticipated.

Archaeology. Based upon the cultural resources records review of the Malakoff to Trinidad-Forest Grove transmission lines study area, no conflict exists with the "Primary Route" with recorded archaeological and historical sites. The "Alternate Route," however, does include one previously recorded prehistoric site, 41HE220, which has been recommended for further testing to determine if it meets the requirements for National Register of Historic Places eligibility.

Summary. As discussed previously, construction within either corridor will not significantly affect the environmental integrity of the area. The "Primary Route" is shorter, requires less clearing of wooded areas, is farther removed from Cedar Creek, and total project costs are estimated to be approximately $96,000 less than those associated with the "Alternate Route."

4.4.1.4 Alternative Water Sources

This section is largely an extraction of information from a summary of a regional screening study undertaken to identify the most favorable source of water for the proposed Malakoff EGS (HL&P, 1980b). Because the Malakoff EGS site lies within the Trinity River basin and in proximity to Cedar Creek Reservoir, an emphasis, during the screening study, was placed on the Trinity River to identify a water source that could supply the required amount of cooling water for the 1200 MW facility.

Of the 129 possible sources or combinations of sources of water for the Malakoff EGS, all but four were eliminated by basic physical, permitting or economic considerations. The four feasible options for the Malakoff EGS water supply are listed below:

1) Cedar Creek Reservoir

2) Lake Palestine

3) Walnut Creek Reservoir with supplemental ground water (two-unit operation only)

4) Walnut Creek Reservoir with makeup from the Trinity River diverted under Permit No. 1970

An economic ranking evaluation was conducted on the remaining four supply sources. A summary of the economic analysis, based upon information provided by HL&P (1980b), is provided below:

Levelized Annual Cost Per Acre-Foot

Option	HL&P Financing	Water District Financing
Cedar Creek Reservoir	$350.16	$307.17
Lake Palestine (at lake)[a]	$562.78	$352.62
Walnut Creek Reservoir with makeup from Trinity River diverted under Permit No. 1970	$699.14	$410.00
Walnut Creek Reservoir with supplemental ground water	$817.33	$486.58

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a. HL&P later decided to relocate the diversion point to an existing channel dam on the Neches River downstream of Lake Palestine. This modification resulted in no relative change in the economic ranking.

The next step was to systematically examine the reliability of the most economic source and to proceed down the economic ranking until an acceptable source was identified, or until all sources were eliminated.

Cedar Creek Reservoir. After careful consideration, use of Cedar Creek Reservoir through a contract with TCWCID #1 for the Malakoff EGS water supply has been eliminated as a favorable option. This decision was based upon the following four points:

1) TCWCID #1 operates its reservoir network on a system basis; consequently, no specific yield of an individual reservoir would be dedicated to HL&P use.

2) From the mid-1980s until the completion and fill of Richland Creek Reservoir, shortages could occur on the TCWCID #1 system.

3) TCWCID #1 will sell to HL&P only water surplus to current and future system demand and will not assume the obligation of supplying an uninterrupted water supply throughout the life of the Malakoff EGS.

4) Future system reliability is dependent upon an adequate long-range development program on the part of TCWCID #1. This future performance cannot be quantified by engineering analysis.

Lake Palestine-Upper Neches River Municipal Water Authority. The UNRMWA was created by special act of the Texas Legislature in March 1956. Originally, the territory was composed of the cities of Rusk, Jacksonville and Palestine. In November 1959, the cities of Rusk and Jacksonville elected to withdraw from the Authority so that the current territory is limited to the City of Palestine. The Authority owns and operates Lake Palestine and will eventually supply or augment the municipal demands of the City of Palestine as an in-district user and the cities of Tyler and Dallas as out-of-district users. Currently, the City of Palestine utilizes only a small portion of its contract amount (3,880,550 m^3 (3,146 ac-ft) in 1978 out of 34,537,636 m^3 (28,000 ac-ft)) by diverting released flows at a downstream Neches River channel dam and pump station. Neither Dallas nor Tyler has constructed pipelines necessary to utilize any of their current contract amounts, which are 141,033,203 m^3 (114,337 ac-ft) and 82,890,326 m^3 (67,200 ac-ft) per year, respectively.

As with TCWCID #1, UNRMWA will serve out-of-district users under Sections 51.137 and 51.188 of the Texas Water Code. In addition, UNRMWA was granted by the Legislature in the enabling act the

> . . . power to cooperate and enter into contracts with cities, persons, firms, corporations, and public agencies for the purpose of supplying and selling them water for municipal, domestic, industrial, and other useful purposes permitted by law, provided that cities and areas constituting the District shall be accorded priority in the allocation of the District's available water, and the Board of Directors shall prescribe rules to effectuate this provision.

More importantly, UNRMWA has indicated that it will assume a contractual obligation to meet the demands of all users, HL&P included, on a continuous, uninterrupted basis.

In order to provide an independent appraisal of the UNRMWA water system, Turner Collie & Braden, Inc. (TCB) was hired to perform a hydrologic review. The TCB review concludes that there is adequate water available to supply all system users, including the Malakoff EGS (TCB, 1980). The TCB results have been updated by HL&P to reflect the latest status of contractual negotiations between the various current and proposed users. The HL&P update indicates a water surplus in the UNRMWA system. Based upon the various engineering evaluations, the UNRMWA system was selected as an economic, reliable source of water for the Malakoff EGS.

Until such time as the permanent water supply is available, a temporary water supply suitable to meet construction needs will be required at the Malakoff EGS from October 1983 through September 1989. This six-year period commences with the projected construction permit date and concludes with the initial operation of the permanent plant makeup supply system. Delivery of water from the permanent system will begin at least three months prior to the trial operation of Unit 1.

Construction water requirements include provisions for a concrete batch plant, fire protection, potable water supply, soil compaction and related operations. A source continuously delivering water at 200 gpm to a sufficiently sized storage facility could satisfy the projected demand. The deficiencies per unit time between outflow and inflow to the storage facility are summed and the total represents the required storage volume. The value resulting from this analysis for the Malakoff EGS is approximately 220,000 gallons of storage including a 75,000-gallon capacity for fire protection. To allow for possible interruptions in delivery from the source, an on-site storage pond of at least five to six acre-feet (about seven days use) is recommended.

Several possible sources of construction water supply were considered:

1) Lake Palestine/Neches River channel dam system (permanent plant makeup source)
2) Local Municipal Supplies
3) Trinity River
4) Walnut Creek
5) Cedar Creek Reservoir
6) Ground Water

All but the last of these sources are located off site; therefore, the options of pumping and trucking water to the site were examined. Thus, a total of 11 possible options were examined as alternative construction water supply systems.

The first of these options is the utilization of the plant's permanent makeup source and system. During operation, the Malakoff EGS will obtain its water from the Lake Palestine/Neches River channel dam system in the adjacent Neches River basin. Since this source will be used throughout the life of the generating facility, it would be cost efficient to utilize this system for construction water as well. However, since installation of the conveyance system to transport the water to the Malakoff EGS cannot be initiated until the construction permit date and is scheduled to take three and a half years to complete, this option is not feasible during the early phases of plant construction.

The next alternative for consideration is temporarily purchasing water from an already developed supply. An examination of existing municipal water supplies in the area reveals that no local system can furnish the necessary quantity. Several small supply companies operate in the area, but none appear to have excess capacity. Consequently, there is no available municipal supply in the region which could provide the quantity of water the Malakoff EGS requires.

Since the Malakoff EGS site is located in the Trinity River basin, options utilizing surface water from within that basin were given consideration. Possible sources therein include appropriate flows in the main stem of the Trinity River, appropriable flows in Walnut Creek immediately south of the site, and the impounded waters of Cedar Creek Reservoir purchased from Tarrant County Water Control and Improvement District #1. Water from any of these sources could be piped or trucked to the site.

To utilize the Trinity River or Walnut Creek as a construction water source, several objectives would have to be accomplished, incorporating about a year's time. Engineering studies would be required to demonstrate that flows are actually available for appropriation and are not claimed by downstream users. An application for permit would then be filed with the Texas Water Commission. After review by the Texas Department of Water Resources, public hearings would be held by the Commission to examine the request and entertain possible protests from interadjacent users. Then, if the Commission sees fit, the permit could be granted. Even though this procedure is time consuming, all the necessary activities can be accomplished prior to the issuance of the construction permit.

Nonetheless, questionable water quality is a significant consideration associated with the Trinity River and Walnut Creek options which make them less desirable. Water quality is an important criteria in the evaulation of these alternatives because, during periods of low flow, they both are almost entirely comprised of municipal effluent. Examination of streamflow records suggests that these two prospective sources experience highly varied and extremely poor quality on an intermittent basis as is indicated by the high fecal coliform counts. Treatment of such water for potable use would be expensive and complex. Any treatment equipment breakdown or malfunction could temporarily incapacitate the entire construction work force. Additionally, reclamation of municipal treatment plant effluent for potable uses has been done only on a very rare and limited basis. For these reasons, Trinity River and Walnut Creek are excluded from further consideration.

Discussion thus far has eliminated all but three possible alternatives for the Malakoff EGS construction water source. The remaining options are piped or trucked-in Cedar Creek Reservoir water and ground water. Since both sources are of sufficient quantity and good quality, the major criteria for comparison are cost, social or community impact.

Truck delivery of water is extremely costly and appears to be feasible only on a strictly temporary basis. Costs were estimated to be $230.00 for delivery of one load of water (4,800 gal) by truck to the site from nearby Cedar Creek Reservoir. To meet the peak requirements, the transportation costs would approach $10,500 daily. Another negative aspect of the trucking option is the social impact of about 100 daily water truck trips on the surrounding community. This source, however, would be adequate on a short-term basis.

The option utilizing water released from Cedar Creek Reservoir, captured at a downstream diversion structure, and pumped by pipeline to the plant is also considered. A contract could be negotiated with the Tarrant County Water Control and Improvement District #1 for the release of flows from the reservoir for the Malakoff EGS use. Construction of an off channel stilling basin, diversion structure, and mile-long pipeline could be initiated on the construction permit date. Until the conveyance system is operable, trucked-in water would suffice. The total estimated cost to construct and operate the system is $718,500 (1981 dollars). Undesirable aspects of this option include the schedule uncertainties associated with contract negotiations and estimating uncertainties associated with pipeline and service road construction in the area between Cedar Creek and the power station site.

The most attractive alternative considered by HL&P was the ground-water option. A single on-site well or possibly two 100-gpm wells can deliver the required flow almost immediately after the construction permit is issued. All testing installation and engineering fees are included in the projected $336,000 cost. Utilizing this option is less expensive, sooner available for use, and less likely to suffer delays due to permitting or contractual considerations since the entire system is located on site.

4.4.2 Mine and Operations Alternatives

4.4.2.1 Mining Methods

Two alternative mining technologies are available for area lignite extraction, underground mining and surface mining. The following is a discussion of the two methods.

Underground Mining. Currently, lignite recovery by underground mining is not practiced in the United States. Strata overlying the mineable lignite contains unlithified sediments which are extremely difficult to economically and safely support. The thin characteristic of the lignite seams provides insufficient vertical clearance for mining equipment and personnel if an appreciable thickness of roof material is left in place. Underground room and pillar techniques average approximately 50 percent recovery of the resource compared with the typical 85 percent mining recovery rate by surface mining. Shallowness of the overburden over the Trinity Lignite Deposit and generally flat nature of the surface topography would cause subsidence of the surface resulting in shallow depressions. The rolling nature of the structure contour and intermittent faulting of the lignite seams would require special mining equipment for the extraction of the lignite by underground mining. Due to these adverse technical factors and the anticipated high cost of underground mining, this mining method is not suitable for the Trinity Lignite Deposit.

Surface Mining. All lignite currently mined in the United States is surface mined. Excavation equipment, such as bucket wheel excavators, truck and shovel, scrapers or draglines, expose the lignite seams. The exposed lignite seams are loaded onto a means of conveyance (e.g., haul trucks) by power shovels, backhoes or front-end loaders. After the lignite has been removed from the mine pit, the pit is backfilled with overburden material removed from the next mining cut excavation. The overburden material is regraded to approximate original contour and reclaimed. Surface mining will provide a maximum recovery level (generally ranging from 85 to 95 percent) of the proposed Trinity Mine's lignite reserve.

4.4.2.2 Overburden Handling

The stratified sediments which occur above the lignite are called overburden. Sediments which occur between lignite seams are called interburden. The surface mining method requires the removal of overburden and interburden in order to remove the lignite. During a normal surface mining operation, excavated overburden and interburden are placed in the previously excavated pit, regraded and reclaimed. Alternative equipment includes: 1) draglines; 2) bucket wheel excavators (BWE) with conveyors; 3) trucks and shovels; 4) scrapers; and 5) cross-pit conveyors and draglines. The final selection of equipment to be used during mining will be based upon a cost benefit analysis which will take into account a number of factors including: 1) safety and highwall stability; 2) reclamation methods; 3) rate of resource recovery; 4) capital investment; and 5) equipment operation and maintenance considerations.

Three methods for overburden and interburden removal and placement are available for the above listed equipment. They are: 1) randomly mixed overburden; 2) segregation of the weathered zone; and 3) topsoil (A horizon) segregation. Because sand and gravel deposits are contained within the overburden material, NACCO has also considered special handling requirements for these materials. A discussion of each of these alternatives follows.

Randomly Mixed Overburden. This alternative requires the excavation of overburden and interburden by one or more of the five listed overburden removal methods. All recognizable toxic and pyritic material is placed at least 48 inches below the surface. Excavated materials are used as backfill for adjacent mined-out pits. The backfill is placed in a random fashion. After the backfill is complete, the surface is graded to the approximate original contour. Once grading is complete, the surface is prepared for revegetation. Revegetation reclamation studies are currently being conducted at the site to determine the feasibility and costs associated with this reclamation method. Inputs to ameliorate this reconstructed plant growth medium for productive revegetation may vary and are dependent upon the physical and chemical conditions of the surface material. Final productivity of a reconstructed plant growth medium composed of randomly mixed overburden, however, must meet the performance standards for "Topsoil Substitutes and Supplements" as set forth in Section 335(e) and/or "Prime Farmland Alternative to Separate Soil Horizon Removal and Stockpiling" set forth in Section 623 of the Texas Coal Mining Regulations (Railroad Commission of Texas, 1981). Reclamation studies are currently in progress at two sites within the project area to determine the feasibility and costs associated with the use of this alternative for portions of the mine. A detailed discussion of the reclamation study objectives is provided in Sec. 4.5.2.4.

Segregation of the Weathered Zone. This alternative requires the excavation of the weathered zone by one or more of the five listed overburden removal methods. In the weathered overburden alternative, the backfill is placed in segregated fashion so that the weathered overburden is returned to the surface. Once grading is complete, the surface is prepared for revegetation. As with the randomly mixed overburden alternative, the final productivity of a newly created soil composed of selected overburden must meet the performance standards as set forth in Sections 335(e) and 623 of the Texas Coal Mining Regulations. A detailed discussion of the reclamation study objectives is provided in Sec. 4.5.2.4.

Topsoil (A Horizon) Segregation. This alternative requires the removal and replacement of the A horizon topsoil on either randomly mixed or selectively placed overburden materials. The soil is then prepared for revegetation. As with the two previous alternatives, there are specific rules set forth in the Texas Coal Mining Regulations governing topsoil removal, storage and replacement. The rules governing topsoil include Sections 334, 335, 336, 337, 338, 620, 621, 622, 623 and 624 (Railroad Commission of Texas, 1981).

All three of the overburden handling methods discussed above are under consideration for use at the Trinity Mine. Feasibility studies, field studies and cost studies are in progress by The North American Coal Corporation to determine the combination of alternatives best suited for the site.

Sand and Gravel Handling Alternatives.

Recovery of Sand and Gravel. Several methods could be used to recover the sand and gravel that occur in pockets from the alluvial areas upward into parts of the upland areas. The pockets occur 7.6 to 10.7 m (20 to 35 ft) from the surface and range in thickness from 0 to 7.6 m (0 to 20 ft). The sand and gravel are above the A and B seams. The sand and gravel appear to wash out the A and B seams in certain locations.

The Trinity Mine plan will require construction and maintenance of nearly 48.3 km (30 mi) of haulroads and numerous service roads throughout the life of the mine. The sand and gravel may be utilized for the construction or maintenance of these roads or, if a market appears, sold to outside interests. In either case, the material will have to be stockpiled and separated by gradation.

A truck/shovel removal system or a bucket wheel excavator in these areas would work the gravel area and segregate the overburden and sand and gravel. Sand and gravel would be stockpiled adjacent to the pit area and would be screened and segregated with a portable crusher-screen system. If the material is not required for use at a specific time, it would be stockpiled. Various mobile equipment may be utilized for cleanup and support of the truck/shovel system when it works the sand and gravel.

Segregation of Sand and Gravel. If recovery of the sand and gravel is not required, the material will be handled so that it will be buried at least 1.2 m (4 ft) below the surface.

If the truck/shovel system is removing the gravel while prestripping for the dragline(s), the trucks will be used to segregate the sand and gravel in the spoil and bury it with other select overburden material, or haul the material to areas in the pit where the coal has been loaded out, thereby leaving it for the dragline(s) to bury on the next pass.

If the dragline is removing overburden in the area without support from the truck/shovel system, it would selectively place the sand and gravel on the pit floor for use as a buckwall.

The material will be handled first in whatever manner it occurs. If it is evident on the dragline bench, it will be placed in the pit first and subsequently buried with the remaining material. If the sand and gravel appear in the pit below the dragline, it will be covered with bench material. If, in isolated areas, the dragline cannot locate sufficient material for covering the sand and gravel, material will be transported from other parts of the pit by mobile equipment to complete the reclamation.

These methods are only a few of which could be utilized for handling the sand and gravel. Other methods may be considered based on the economics of recovery of the resource and legal constraints associated with ownership of the sand and gravel.

4.4.2.3 Resource Recovery and Transportation

Lignite Loading Alternatives. Four lignite loading alternatives are under evaluation: 1) power shovel; 2) hydraulic backhoe; 3) front-end loader; and 4) continuous miner.

Power Shovel. Power shovels are used extensively to load lignite in Texas. Shovels have a high breakout force to remove lignite without ripping or blasting. A haul truck parked on top of the lignite seam can be loaded by the shovel to keep haul trucks off the potentially soft mine-pit floor. The crawlers on the shovel provide greater mobility and flotation on wet, soft mine-pit floors. Economics will decide if the power shovel is used at the Trinity Mine.

Hydraulic Backhoe. Hydraulic backhoes have gained wide acceptance in the United States as a primary lignite-loading method. Excellent mobility and high breakout force allow the backhoe to load in-place lignite without ripping or blasting. The backhoe avoids contact with the soft mine-pit floor by resting on the top of the lignite seam for hauler loading. The backhoe is highly maneuverable and selective in removal of the lignite seam with little dilution and excellent recovery. Economics will decide if the hydraulic backhoe is the preferred choice for the Trinity Mine.

Front-end Loader. Front-end loaders have been used extensively in the removal of lignite in the United States. Good floor conditions must exist on the pit floor for the front-end loader to develop sufficient breakout force by driving into the lignite seam. When not in use for lignite loading, the front-end loader can be used for other moving activities.

Continuous Miner. Continuous miner application to lignite surface mining has been used in only one lignite mine in Texas to date. Rotating buckets or blades on the continuous miner slice off 8- to 30-cm (3- to 12-in.) lifts of the lignite seam as the miner moves across the top of the lignite seam. A cantilevered conveyor projects off the side of the miner to load haul trucks. The continuous miner works well in removing thin seams, but has a low amount of productivity which may not meet the requirements of high tonnage production for the Trinity Mine.

Lignite Transportation Alternatives. Generally, three methods are available for transportation of lignite to a mine-mouth power plant: 1) trains; 2) haul trucks; and 3) conveyors.

Trains. Trains have been used to transport lignite from loading piles or silos to the power plant. However, more than 16.1 km (10 mi) of one-way haulage distance is usually required for economical lignite haulage by rail system. The rail system would require frequent moves as mining progresses and would operate well only on flat grades. Trains may not be economically suited to the shorter haulage distances initially present at the Trinity Mine.

Haul Trucks. Haul trucks provide excellent mobility and flexibility compared with conveyors or trains. Relatively constant production rates may be maintained from mine pits to loading silo. Use of haul trucks to transport lignite from the pit to the mine storage is the presently preferred alternative for the Trinity Mine.

Conveyors. Continuous transport of the lignite from the loading machine to the power plant lignite handling facility is the primary advantage of conveyor systems. The requirement for a complex haulroad system is reduced with conveyor haulage. As haulage distances increase, conveyors may be used as a means of transporting lignite from the pit to the silo. Currently, a conveyor will be used to transport lignite from the mine storage to the Malakoff EGS.

4.4.2.4 Reclamation

Reclamation is required to be conducted contemporaneously with mining. Explicit performance standards for revegetation of surface mined lands in Texas are given in the Texas Coal Mining Regulations. The North American Coal Corporation, as operator of the Trinity Mine, must obtain a permit to mine and comply with the Texas Surface Coal Mining Regulations. Therefore, the alternatives for reclamation and revegetation are limited to those contained in the regulations. Sections 390, 391, 392, 393, 394, 395, 396 and PART 823 all apply to the reclamation and revegetation of surface mined lands (Railroad Commission of Texas, 1981).

Revegetation. NACCO is presently conducting field tests to determine which species of vegetation are most prolific on the various soils and soil substitutes presently being evaluated. Species are grouped, according to intended use, into the following three categories by NACCO: 1) improved pasture/hayfield; 2) forestland; and 3) wildlife habitat.

Species being evaluated for improved pasture/hayfield use include coastal bermudagrass and subterranean clover. Forestland species include loblolly pine, green ash and water oak. Species being evaluated for use as wildlife habitat include autumn olive, arrowleaf clover, dallis grass, hairy vetch, subterranean clover, switchgrass, loblolly pine, green ash and water oak.

Postmining Land Use. The anticipated postmining land use projections are subject to lease holder requests and RRC regulations. The RRC regulations governing postmining land use of surface-mined lands are found in Section 399 of the "Coal Mining Regulations" published by the Railroad Commission of Texas. The two postmining land use alternatives evaluated in Sec. 5.0 are discussed below.

Return to Existing Conditions. The applicant's preferred postmining land use is an approximation of the existing land use acreage within the area to be mined, although the distribution of various land use categories will likely be different between premining and postmining conditions. Existing land use is discussed in Sec. 5.22 of this document.

Conversion to 100 Percent Improved Pasture. The alternative postmining land use evaluated in the Environmental Consequences section of this document is conversion from the existing land use to 100 percent improved pasture. This alternative is evaluated because the majority of mined lands in Texas have previously been converted to improved pasture. Contributing factors leading to conversion to improved pasture include landowner preference and the ability of some species of improved pasture grasses to quickly establish a vegetative cover capable of stabilizing the soil surface from erosion. This alternative land use could be planned to include trees and shrubs along fence rows and stream borders to afford wildlife habitat.

4.5 DESCRIPTION OF PROJECT ALTERNATIVES

4.5.1 Station Systems and Operating Characteristics

4.5.1.1 External Appearance and General Arrangement

The Malakoff EGS will consist of two 600-MW lignite-fired electric generating units, with cooling towers, lignite and limestone storage areas, water and wastewater treatment systems, and switchyard located on approximately 164 ha (400 ac) 4.8 km (3 mi) southwest of Malakoff in Henderson County, Texas. The materials handling area will be located on a 215.3-ha (525-ac) area adjacent to and northeast of the plant site. The plant site grade is at 98.85 m (329.5 ft) msl. The project coordination map is shown on Fig. 4-4. The plant site will be accessible by a 7.7-km (4.8-mi) rail spur running south from the St. Louis-Southwestern Railway. The spur will run along the east side of the materials handling area and will enter the plant from the east side. The plant site will also be accessible by a 2.19-km (1.36-mi) road off State Highway 31, which will enter the plant from the

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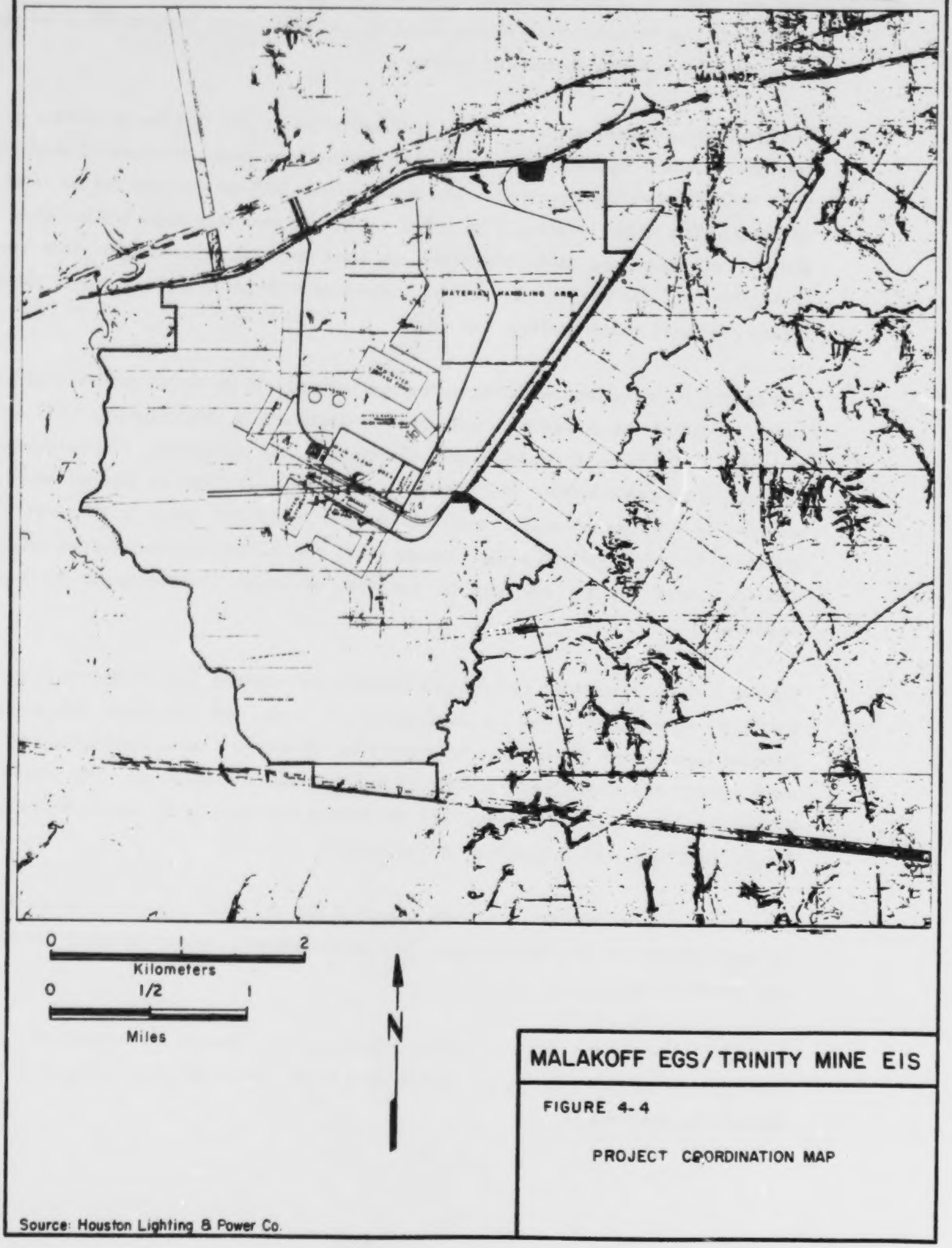

MALAKOFF
MATERIAL HANDLING AREA
MAIN PLANT AREA
0
1
2
Kilometers
0
1/2
1
Miles
N

MALAKOFF EGS / TRINITY MINE EIS

FIGURE 4-4

PROJECT COORDINATION MAP

Source: Houston Lighting & Power Co.

northwest side. A secondary access road, 3.08 km (1.91 mi) in length, will enter the plant on the east side from Farm-to-Market Road 90. All permanent roads at the plant will be constructed of concrete or crushed limestone.

The main powerhouse, which includes each unit's boiler and turbine-generator, and the common control complex will be a multilevel, partially enclosed structure of conventional steel-braced-frame construction. The ground floor will be constructed of reinforced concrete. The upper levels will be either reinforced concrete slab, welded steel floor grating, or checkered plate supported on steel framing. Equipment that requires protection from the environment will be enclosed with masonry walls or metal siding and a steel roof deck and/or built-up roofing.

The control building, located between the two boilers, will be totally enclosed with metal siding. East of the powerhouse will be the electrostatic precipitators, FGD scrubber modules, 190-m (625-ft) stacks, and sludge stabilization equipment. The switchyard will be west of the powerhouse. The lignite and limestone piles will be located south of the powerhouse. Common water and wastewater treatment areas with several small prefabricated buildings and water storage tanks will be west of the storage piles. The cooling towers will be adjacent to the makeup water storage pond, north of the powerhouse.

Lignite fuel for plant operation will be mined from reserves located generally south and southeast of the plant site. A combination of trucks and conveyors will be used to transfer lignite from the mine to the plant site. Trucks will carry lignite from the pit to mine storage which will feed a 3.2-km (2-mi) long overland conveyor. The conveyor will deliver lignite to a transfer house near the lignite storage pile for use in the plant. The lignite handling system is discussed in Sec. 4.5.1.3.

Limestone will be brought in by rail, unloaded into a hopper and conveyed to the fully-enclosed limestone pile for storage. The enclosure will consist of steel framing with corrugated metal siding.

All metal siding at the plant site will be painted green. The site will be graded and seeded with grass to prevent erosion, and to provide a landscaped appearance compatible with the surrounding environs.

The makeup water for the plant will be pumped 72.5 km (45 mi) by pipeline from the Neches River (Fig. 4-5). The intake structure on the Neches River will be located about 48.3 km (30 mi) south of Lake Palestine. Makeup water will be stored on site in a 15.6-ha (38-ac) clay-lined pond.

4.5.1.2 Boiler and Steam-Electric System

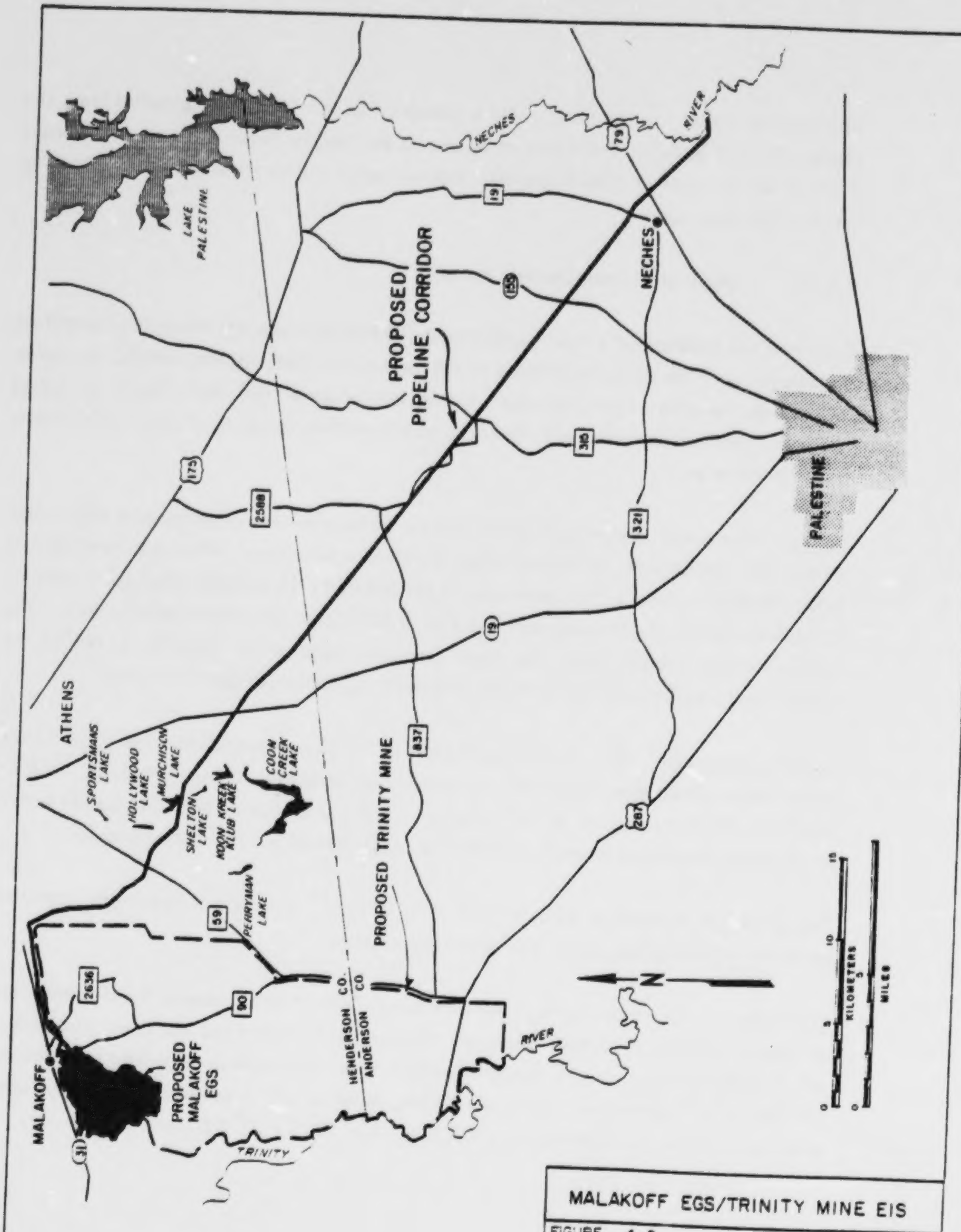
Each unit has a design net output capability of 600 MW when burning the performance fuel and operating at the design conditions of the mechanical draft cooling towers. As shown in Fig. 4-6, the steam cycle includes a boiler, turbine-generator, seven-heater (including deaerator) feedwater cycle, twin half-size turbine-driven boiler feed pumps, and multi-pressure condenser.

Boiler. The boiler is a balanced draft natural circulation drum type burning 605 metric tons/hr (665 tons/hr) of lignite fuel under worst-case conditions. Maximum fuel input is 7,000 MKB/hr. The boiler generates 2,295,000 kg/hr (5,100,000 lb/hr) of steam at 1,842,043.4 kg/m^2 (2,620 psig) and 540.6°C (1,005°F) at the superheater outlet. The boiler reheats steam from the high pressure turbine to 540.6°C (1,005°F) at 435,903 kg/m^{2}g (620 psig) for use in the intermediate and low pressure turbines.

Turbine-Generator. The turbine-generator is a tandem-compound, four flow single stage reheat steam type developing 713,850 kW of generator output with 2,208,393.4 kg (4,907,541 lb) of steam flow at 1,771,736 kg/m^{2}g (2,520 psig) and 537.8°C (1,000°F) with a design absolute exhaust pressure of 6.98/10.8 cm (2.75/4.25 in.) Hg at the condenser.

The generator is rated at 855,100 kVA at 3,600 rpm. The exciter associated with this generator is a Generrex static type excitation system.

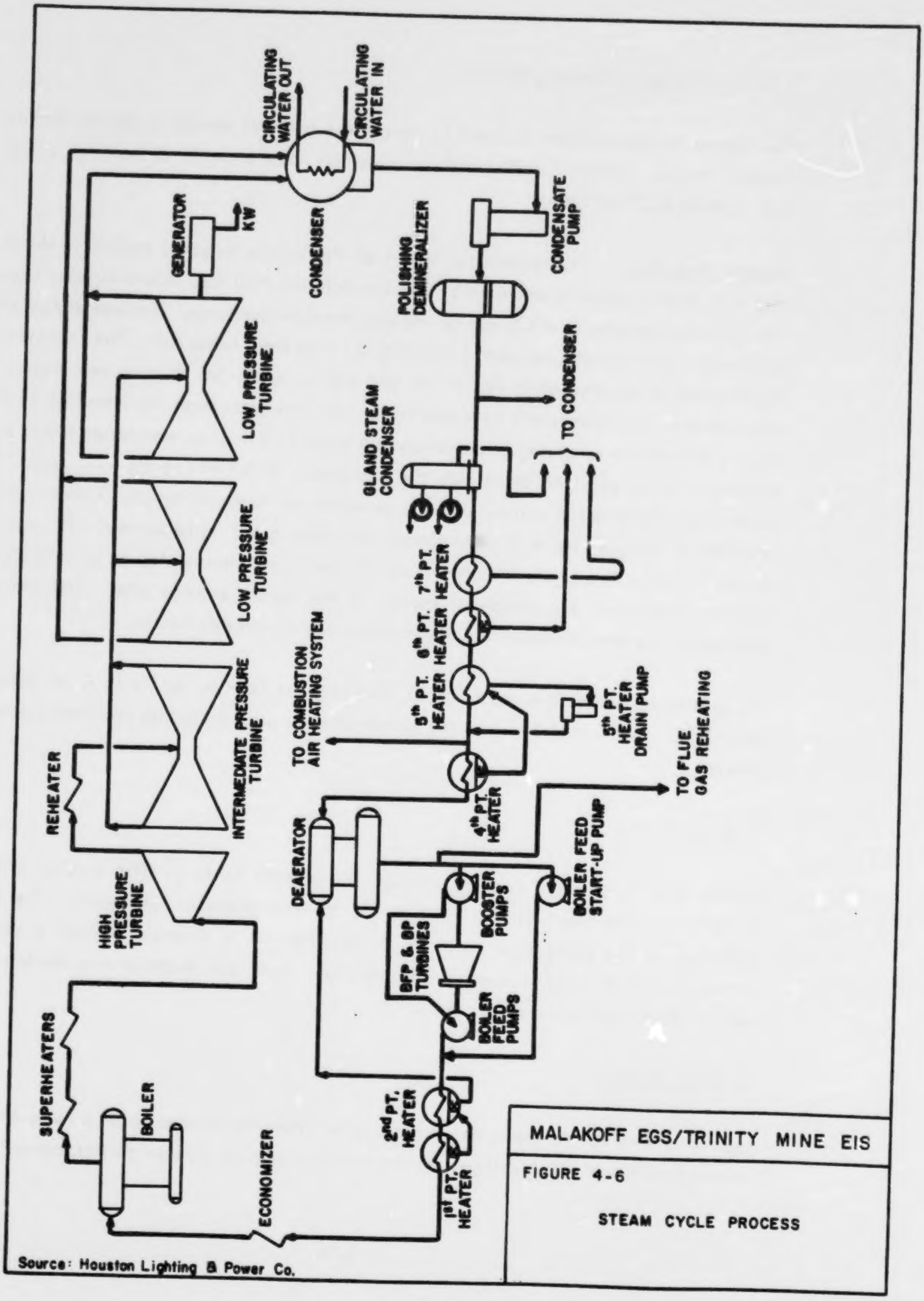
Condenser. The condenser is a two-zone type. The characteristics of the condenser are as follows: 90-10 Cu-Ni tube material, 18 gage, 1.91 cm (3/4 in.) diameter, and 24.4 m (80 ft) effective tube length. The total surface area of the tube arrangement is 40,306 m^2 (447,846 ft^2). The tube velocity of the cooling water is 2.07 m/sec (6.8 ft/sec). The total heat rejection from the condenser is 922,320 kWh/hr (3.15 x 10^9 BTU/hr) for each unit.


LAKE PALESTINE
NECHES
RIVER
79
19
PROPOSED PIPELINE CORRIDOR
NECHES
155
175
2588
315
PALESTINE
321
19
ATHENS
SPORTSMANS LAKE
HOLLYWOOD LAKE
MURCHISON LAKE
SHELTON LAKE
KOON KREEK KLUB LAKE
COON CREEK LAKE
PERRYMAN LAKE
59
PROPOSED TRINITY MINE
837
287
2636
90
HENDERSON CO.
ANDERSON CO
RIVER
MALAKOFF
PROPOSED MALAKOFF EGS
31
TRINITY
N
0 5 10 15
KILOMETERS
0 5
MILES

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-5

LOCATION OF PROPOSED MAKEUP WATER PIPELINE CORRIDOR


CIRCULATING WATER OUT
CIRCULATING WATER IN
CONDENSER
GENERATOR
KW
CONDENSATE PUMP
POLISHING DEMINERALIZER
TO CONDENSER
GLAND STEAM CONDENSER
LOW PRESSURE TURBINE
LOW PRESSURE TURBINE
INTERMEDIATE PRESSURE TURBINE
REHEATER
HIGH PRESSURE TURBINE
SUPERHEATERS
BOILER
ECONOMIZER
7th PT. HEATER
6th PT. HEATER
5th PT. HEATER
5th PT. HEATER DRAIN PUMP
TO COMBUSTION AIR HEATING SYSTEM
4th PT. HEATER
TO FLUE GAS REHEATING
DEAERATOR
BOOSTER PUMPS
BOILER FEED START-UP PUMP
BFP & BP TURBINES
BOILER FEED PUMPS
2nd PT. HEATER
1st PT. HEATER

Source: Houston Lighting & Power Co.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-6

STEAM CYCLE PROCESS

4.5.1.3 Lignite Handling System

The lignite handling system is sized to handle the two-unit maximum lignite demand of 1,210.3 metric tons/hr (1,330 tons/hr) based on lignite with a heating value of 3.39 KWh/kg (5,271 BTU/lb).

System Operation. The schematic layout of the lignite handling system is shown on Fig. 4-7. Mined lignite is delivered by 109.2-metric ton (120-ton) trucks to mine storage. The feeders discharge to a 3.22-km (2-mi) long overland conveyor. The overland conveyor will consist of a partially enclosed 1.8-m (72-in.) wide steel cable belt. The conveyor will be elevated to approximately 285 ft msl and will be supported on open box trusses and steel towers. The towers will be supported on concrete piers with the interface between steel and concrete occurring at elevation 81.4 m (267 ft) msl. A maintenance access and walkway will be provided along side the conveyor. A 3.7-m (12-ft) wide access road located at natural grade will parallel the conveyor for its entire length. Culverts will be provided at the crossing of Walnut Creek and other areas as necessary. The overland conveyor enters the coal yard area from the south and terminates at an intermediate transfer house near the southwest corner of the lignite storage pile. The lignite is sampled at this transfer house and then conveyed to the crusher house.

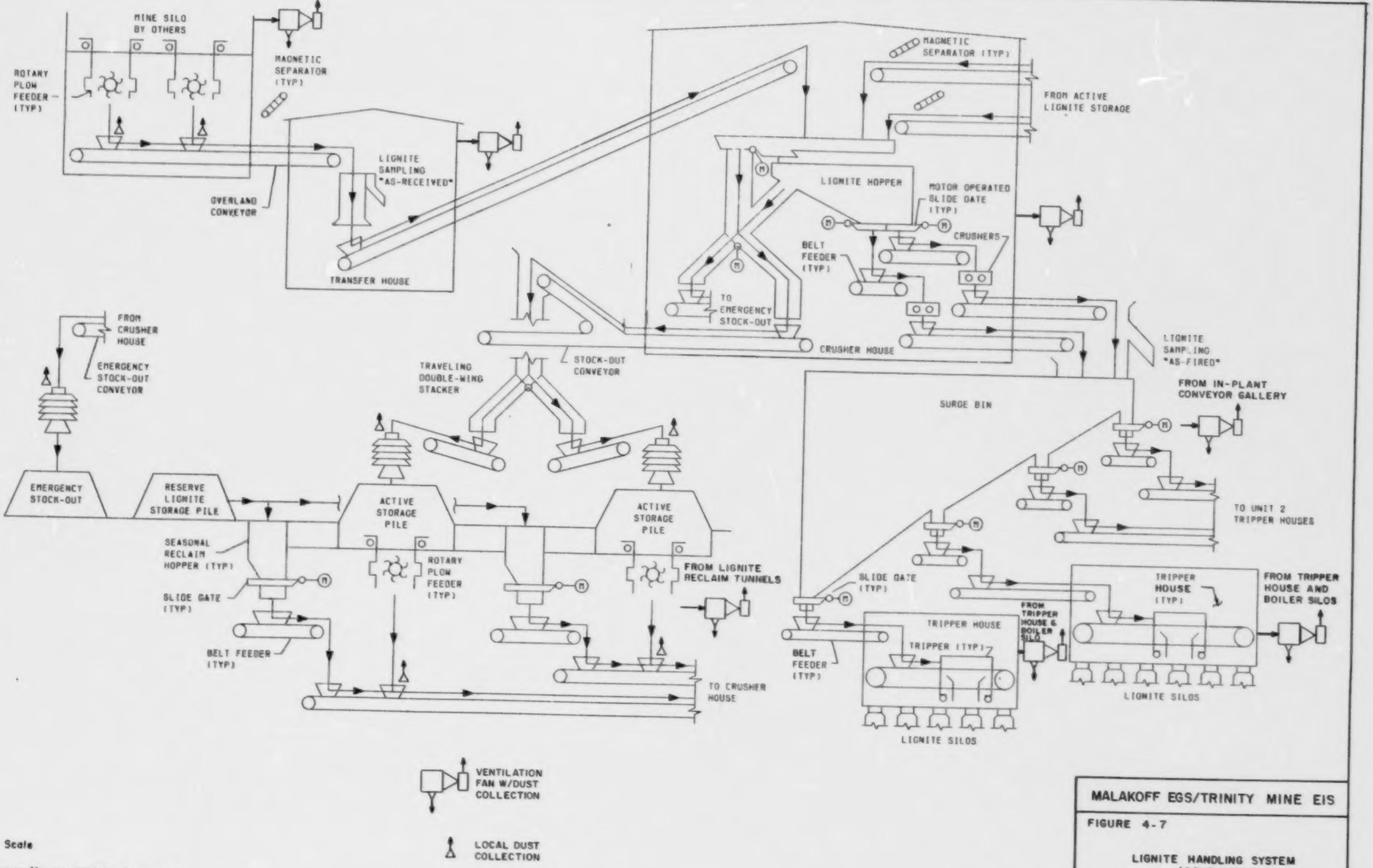
The crusher house has the capability of directing the flow of lignite to three locations: directly to the in-plant silos; to the active storage pile; or to the emergency stockout system.

To in-plant silos:

Lignite that is directed straight through the crusher house is first crushed and then delivered to the plant by one of two 100-percent capacity conveyors. The lignite delivered to the plant goes to a surge bin where it is diverted through a series of conveyors to four rows of in-plant storage silos. Each silo discharges to feeders which feed the boiler pulverizers.

To active storage:

Lignite is diverted to the active storage piles from the crusher house by way of a yard stockout conveyor which delivers lignite to a double wing stacker that stocks out lignite


MINE SILO BY OTHERS
ROTARY PLOW FEEDER (TYP)
MAGNETIC SEPARATOR (TYP)
OVERLAND CONVEYOR
LIGNITE SAMPLING "AS-RECEIVED"
TRANSFER HOUSE
MAGNETIC SEPARATOR (TYP)
FROM ACTIVE LIGNITE STORAGE
LIGNITE HOPPER
MOTOR OPERATED SLIDE GATE (TYP)
CRUSHERS
BELT FEEDER (TYP)
TO EMERGENCY STOCK-OUT
CRUSHER HOUSE
LIGNITE SAMPLING "AS-FIRED"
FROM IN-PLANT CONVEYOR GALLERY
SURGE BIN
TO UNIT 2 TRIPPER HOUSES
FROM CRUSHER HOUSE
EMERGENCY STOCK-OUT CONVEYOR
TRAVELING DOUBLE-WING STACKER
STOCK-OUT CONVEYOR
EMERGENCY STOCK-OUT
RESERVE LIGNITE STORAGE PILE
ACTIVE STORAGE PILE
ACTIVE STORAGE PILE
SEASONAL RECLAIM HOPPER (TYP)
ROTARY PLOW FEEDER (TYP)
FROM LIGNITE RECLAIM TUNNELS
SLIDE GATE (TYP)
BELT FEEDER (TYP)
TO CRUSHER HOUSE
SLIDE GATE (TYP)
BELT FEEDER (TYP)
TRIPPER HOUSE
TRIPPER (TYP)
FROM TRIPPER HOUSE & BOILER SILO
TRIPPER HOUSE (TYP)
FROM TRIPPER HOUSE AND BOILER SILOS
LIGNITE SILOS
LIGNITE SILOS
VENTILATION FAN W/DUST COLLECTION
LOCAL DUST COLLECTION

No Scale

Source: Houston Lighting & Power Co.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-7

LIGNITE HANDLING SYSTEM (SCHEMATIC)

to the active storage piles. The two active storage piles are each 29.96 m (131 ft) wide, 152.4 m (500 ft) long, and 20.12 m (66 ft) high. The lignite is reclaimed from the bottom of the pile by rotary plow feeders which discharge to a tunnel reclaim conveyor that returns the lignite to the crusher house. The lignite is then sent to the in-plant silos as described in the previous paragraph.

To reserve storage:

As lignite accumulates in the emergency stockout pile, it can be bulldozed to the reserve storage pile and compacted for use at a later time (usually peak load periods). Lignite is reclaimed from the reserve storage pile by bulldozing it into the active piles or into reclaim hoppers located at the ends of the active storage piles. Lignite reclaimed from the reserve storage area is conveyed on the same tunnel reclaim conveyor and delivered to the crusher house.

4.5.1.4 Plant Water Systems

Water Sources. Plant makeup water is fresh water provided by the Upper Neches River Municipal Water Authority and supplied by a diversion of the Neches River. Table 4-3 presents water quality data from the Neches River and Lake Palestine. The average annual withdrawal rate of makeup water from the Neches River for the two-unit site is estimated at 17,885,561.5 m^3 (14,500 ac-ft). Plant processes which use makeup and recycled water are described in Tables 4-4 and 4-5 for the 100 percent and 68 percent plant capacity factors, respectively. The 100 percent plant capacity reflects the average Neches River water withdrawal rate required during continuous full plant operation. The 68 percent plant capacity factor is a yearly average of plant operation which accounts for those periods when the plant is not operating due to maintenance outages, etc., or operating at reduced loads. Intermittent flows are converted to averaged continuous values, so that the overall plant water balance can be viewed on a comparative basis.

In order to minimize the volume of water diverted from the Neches River, plant wastewater is recycled and reused. Cooling tower blowdown from the auxiliary cooling water system is reused in the main circulating water system. Cooling tower blowdown from the main circulating water system and boiler blowdown are recycled to the flue gas desulfurization system. Other station wastes, including coal pile runoff, water treatment wastes, oily waste water, and metal cleaning wastes, are collected and treated to comply

TABLE 4-3

TDWR WATER QUALITY DATA

NECHES RIVER AND LAKE PALESTINE

Parameter	Lake Palestine (mid-lake) (TWDR Gage 0605.0100)[a]			Neches River at U.S. Highway 175 East of Frankston (TDWR Gage 0604.0600)[b]		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Specific Conductance (micromhos/cm)	178	160	210	183	125	640
pH (standard units)	7.2	6.7	8.0	7.1	6.3	8.0
Dissolved Oxygen (mg/L)	8.5	5.9	10.5	8.0	5.4	11.0
Total Dissolved Solids[c] (mg/L)	110	97	121	---	---	---
Chloride (mg/L)	24	21	27	20	9	35
Sulfate (mg/L)	22	8	30	19	9	25

a. Data reported for water year 1978.

b. Data reported for period of record 1972-1978.

c. TDS data not reported by TDWR; values shown are from USGS records, 1978-1979.

Source: TNRIS, 1981; USGS, 1979, 1980a.

TABLE 4-4
WATER USE AND CONSUMPTION
100 PERCENT PLANT CAPACITY

System	Water Use[a] (gpm)	Remarks	Makeup Water[a] Raw Water Requirements	Makeup Water[a] Recycled	Recycle Source
Main Cooling Towers	11,200	-	10,950	250	Auxiliary Cooling Tower Blowdown
Auxiliary Cooling Tower	500	-	500	-	-
Flue Gas Desulfurization (FGD) including waste treatment	2,670	1,600 gpm recycle, 1,070 gpm Seal Water		1,590	Main Cooling Tower Blowdown
				10	Boiler Blowdown
Service Water		Total service water use is 1,735 gpm			
Floor and Equipment Washing	50		50	-	-
Seal Water		Total of items (a) thru (e) is 1,485 gpm			
a) FGD & waste treatment	1,070		1,070	-	-
b) Bottom ash handling system	260		260	-	-
c) Circulating water pumps	45		45	-	-
d) Makeup water pumps	30		30	-	-
e) Miscellaneous use	70		70	-	-
Boiler Feedwater		Total of items (a) thru (d) is 165 gpm			
a) Blowdown	10		10	-	-
b) Soot blowing	80		80	-	-
c) Demineralizer regeneration consumption	60		60	-	-
d) Boiler Chemical Cleaning:					
- Organic	5	Once/yr, 1.6×10^6 gal per cleaning	5	-	-
- Inorganic	10	Once/3 yr, 2.4×10^6 gal per cleaning	10	-	-
HVAC	25	Evaporative Coolers	25	-	-
Dust Suppression: Coal pile treatment	(negligible)	100,000 gal/treatment	(negligible)	-	-
Boiler Fireside Wash	(negligible)	2 times/yr	(negligible)	-	-
Air Preheater Wash	10	2 times/yr	10	-	-
Water Treatment Consumption: Clarifier sludge discharge	10	4 times/yr	10	-	-

TABLE 4-4 (Concluded)

System	Water Use[a] (gpm)	Remarks	Makeup Water[a]		Recycle Source
			Raw Water Requirements	Recycled	
Bottom Ash Handling System	40	-	-	40	Wastewater Treatment Plant Effluent
Makeup Evaporation	40	-	40	-	-
Potable Water	20	-	20	-	-
TOTALS			13,245	1,890	

a. Annual average flow.

TABLE 4-5
WATER USE AND CONSUMPTION
68 PERCENT PLANT CAPACITY

System	Water Use^a (gpm)	Remarks	Makeup Water^a		Recycle Source
			Raw Water Requirements	Recycled	
Main Cooling Towers	7,610	-	7,440	170	Auxiliary Cooling Tower Blowdown
Auxiliary Cooling Tower	340	-	340	-	-
Flue Gas Desulfurization (FGD) including waste treatment	1,805	1,080 gpm recycle, 725 gpm Seal Water		1,075	Main Cooling Tower Blowdown
				10	Boiler Blowdown
Service Water					
Floor and Equipment Washing	50	Total service water use is 1,210 gpm	50	-	-
Seal Water		Total of items (a) thru (e) is 1,000 gpm			
a) FGD & waste treatment	7250		725	-	-
b) Bottom ash handling system	175		175	-	-
c) Circulating water pumps	30		30	-	-
d) Makeup water pumps	20		20	-	-
e) Miscellaneous use	50		50	-	-
Boiler Feedwater		Total of items (a) thru (d) is 115 gpm			
a) Blowdown	5		5	-	-
b) Soot blowing	55		55	-	-
c) Demineralizer regeneration consumption	40		40	-	-
d) Boiler Chemical Cleaning:					
- Organic	5	Once/yr, 1.6×10^6 gal per cleaning	5	-	-
- Inorganic	10	Once/3 yr, 2.4×10^6 gal per cleaning	10	-	-
HVAC	25	Evaporative Coolers	25	-	-
Dust Suppression:					
Coal pile treatment	(negligible)	100,000 gal/treatment	(negligible)	-	-
Boiler Fireside Wash	(negligible)	2 times/yr	(negligible)	-	-
Air Preheater Wash	10	2 times/yr	10	-	-
Water Treatment Consumption:					
Clarifier sludge discharge	10	4 times/yr	10	-	-

TABLE 4-5 (Concluded)

System	Water Use[a] (gpm)	Remarks	Makeup Water[a]		Recycle Source
			Raw Water Requirements	Recycled	
Bottom Ash Handling System	30	-	-	30	Wastewater Treatment Plant Effluent
Makeup Evaporation	40	-	40	-	-
Potable Water	20	-	20	-	-
TOTALS			9,050	1,280	

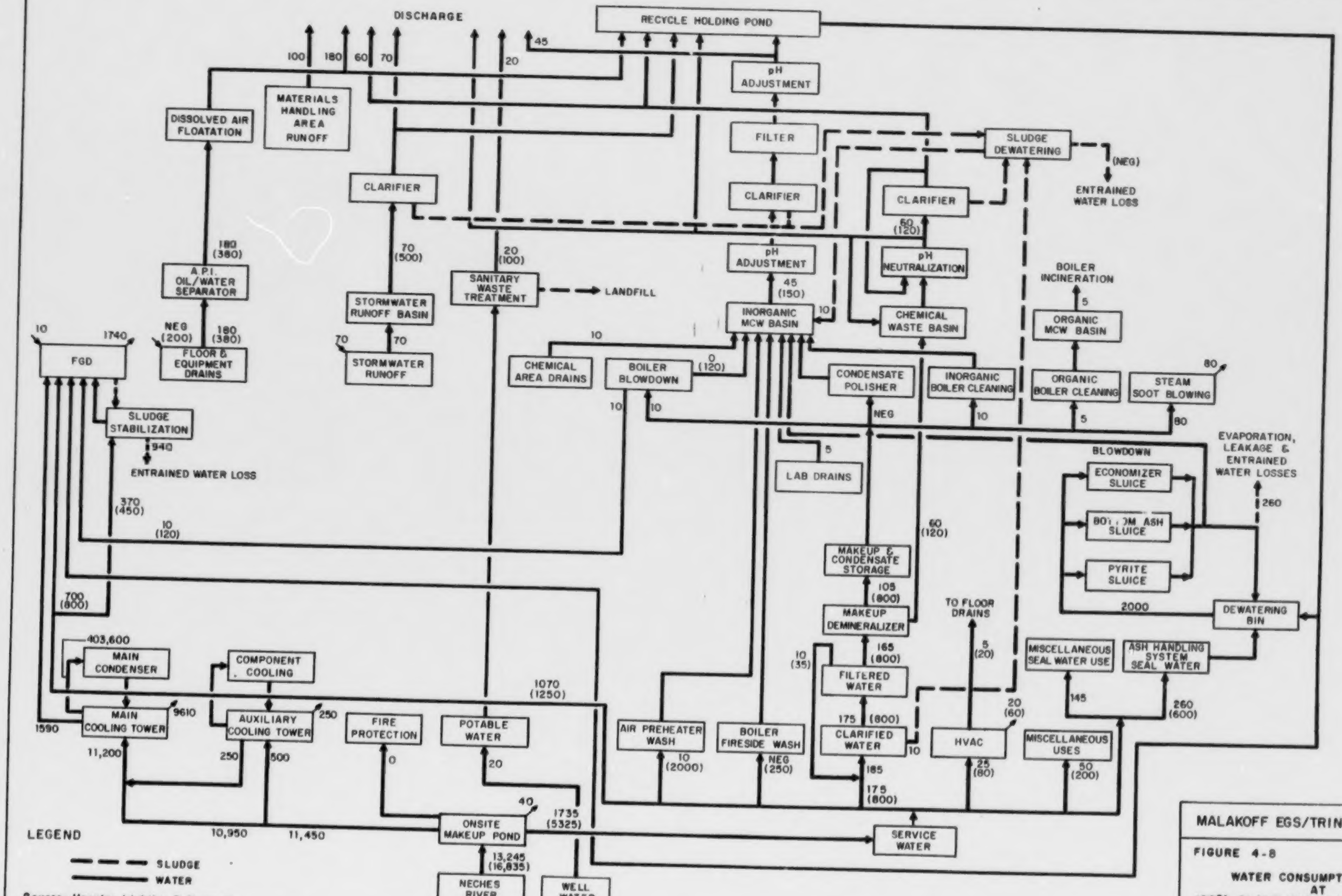
a. Annual average flow.

with applicable limitations pursuant to the effluent guidelines and stream standards. After treatment, these wastewaters are either reused, if possible, or discharged off site. Water balance diagrams which describe both the water uses and the wastewater flows for the 100 percent and 68 percent capacity factors are presented in Figs. 4-8 and 4-9, respectively.

Water Intake Systems and Transportation. Makeup water will be withdrawn from the Neches River via an intake structure located at river mile 327.3. The intake structure will be constructed of reinforced concrete and supported on driven or drilled piers. Water will be conveyed from the intake structure to a pump station by a 1.98-m (78-in.) diameter concrete intake conduit 251.5 m (825 ft) long. From the pump station, water is transported to the power plant site via a 1.1-m (42-in.) buried pipeline. The makeup water will be stored in an on-site pond, ensuring a continual supply of water in the event of a temporary loss of off-site water supply. The storage pond is sized to contain approximately 814,101.4 m^3 (660 ac-ft) of water. This volume will provide up to seven days working storage at full load during the summer. An intake structure is provided on the storage pond for raw water makeup and transfer pumps. Three 50-percent raw water makeup pumps will supply water to the cooling towers, and three 50-percent service water pumps will supply the remaining plant water requirements. The storage pond and circulating water system designs are based on maintaining a level in the pond corresponding to 518,064.5 m^3 (420 ac-ft) at all times.

Main Circulating Water Systems. The plant will use a closed cycle cooling system. Approximately 12,731.70 liters/sec (201,800 gpm) per unit of circulating water is sent through condensers to remove residual heat from the steam cycle. After passage through the condensers, cooling water is pumped to wet, mechanical-draft cooling towers where evaporation cools the water to a temperature suitable for reuse. The major plant water losses occur during the evaporative cooling process. The average annual evaporation from the closed loop cooling system is approximately 302.84 liters/sec (4,800 gpm) per unit. Drift, consisting of cooling water droplets entrained in the cooling tower air flow, results in a water loss of 0.31 liters/sec (5 gpm) per unit. Thus, the total loss due to evaporation and drift is 303.15 liters/sec (4,805 gpm) per unit, or 606.30 liters/sec (9,610 gpm) for the two-unit plant.

Evaporative water loss in the closed cycle cooling system causes concentration of chemical constituents in the makeup water. Uncontrolled chemical concentration results

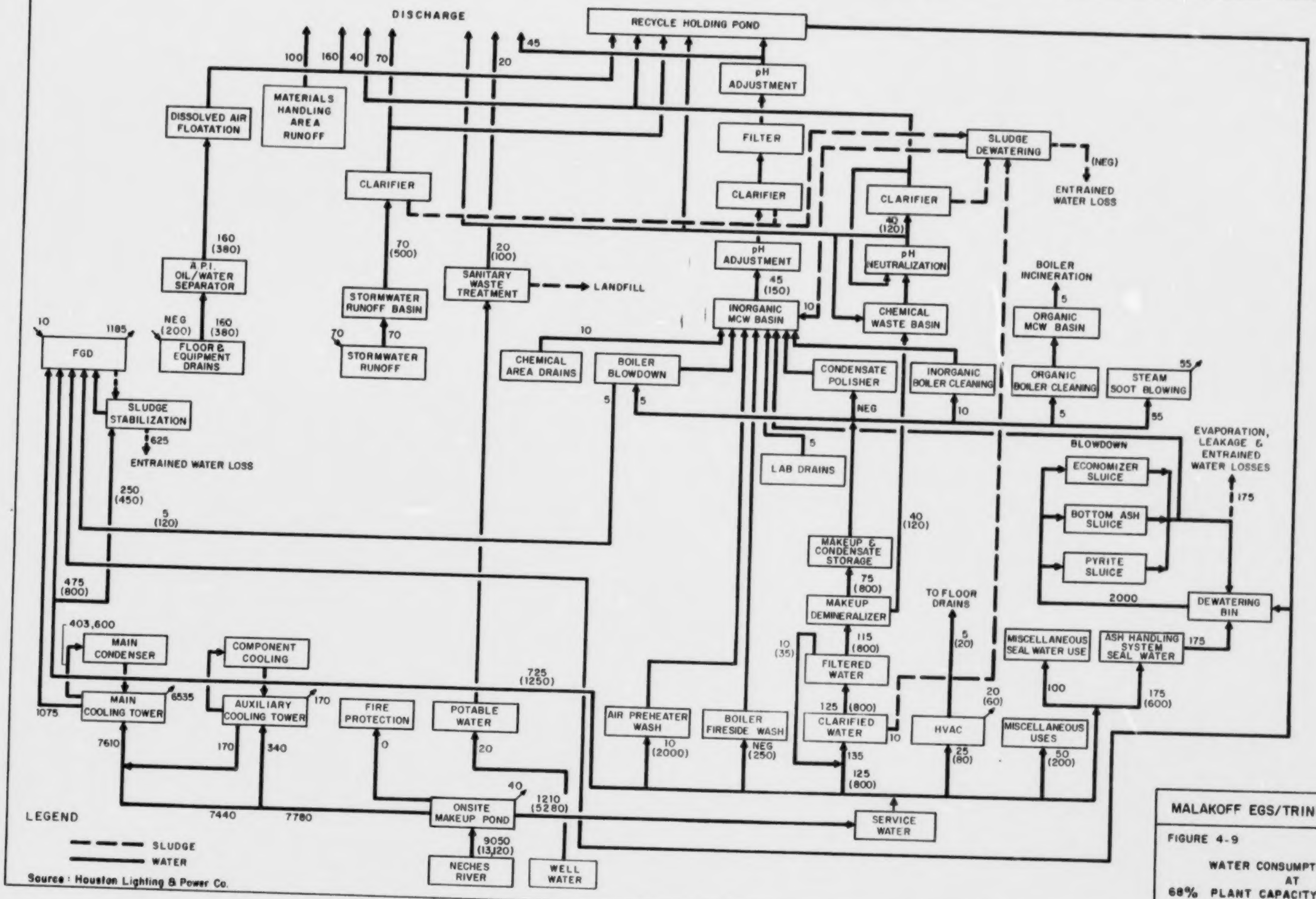

DISCHARGE
100
180
60
70
20
45
RECYCLE HOLDING POND
pH ADJUSTMENT
FILTER
CLARIFIER
SLUDGE DEWATERING
(NEG)
ENTRAINED WATER LOSS
DISSOLVED AIR FLOATATION
MATERIALS HANDLING AREA RUNOFF
CLARIFIER
CLARIFIER
60 (120)
pH NEUTRALIZATION
pH ADJUSTMENT
45 (150)
180 (380)
A.P.I. OIL/WATER SEPARATOR
70 (500)
20 (100)
SANITARY WASTE TREATMENT
LANDFILL
STORMWATER RUNOFF BASIN
INORGANIC MCW BASIN
10
CHEMICAL WASTE BASIN
BOILER INCINERATION
5
ORGANIC MCW BASIN
10
1740
NEG (200)
180 (380)
FGD
FLOOR & EQUIPMENT DRAINS
70
70
STORMWATER RUNOFF
10
CHEMICAL AREA DRAINS
BOILER BLOWDOWN
0 (120)
CONDENSATE POLISHER
INORGANIC BOILER CLEANING
ORGANIC BOILER CLEANING
80
STEAM SOOT BLOWING
SLUDGE STABILIZATION
10
10
NEG
10
5
80
940
ENTRAINED WATER LOSS
5
LAB DRAINS
BLOWDOWN
EVAPORATION, LEAKAGE & ENTRAINED WATER LOSSES
ECONOMIZER SLUICE
BOTTOM ASH SLUICE
260
370 (450)
10 (120)
60 (120)
PYRITE SLUICE
MAKEUP & CONDENSATE STORAGE
105 (800)
700 (800)
2000
DEWATERING BIN
MAKEUP DEMINERALIZER
TO FLOOR DRAINS
403,600
MAIN CONDENSER
COMPONENT COOLING
10 (35)
165 (800)
5 (20)
MISCELLANEOUS SEAL WATER USE
ASH HANDLING SYSTEM SEAL WATER
FILTERED WATER
1070 (1250)
9610
250
20 (60)
145
260 (600)
MAIN COOLING TOWER
AUXILIARY COOLING TOWER
FIRE PROTECTION
POTABLE WATER
AIR PREHEATER WASH
BOILER FIRESIDE WASH
175 (800)
CLARIFIED WATER
10
HVAC
MISCELLANEOUS USES
1590
11,200
250
500
0
20
10 (2000)
NEG (250)
185
25 (80)
50 (200)
175 (800)
40
1735 (5325)
LEGEND
10,950
11,450
ONSITE MAKEUP POND
SERVICE WATER
SLUDGE
WATER
13,245 (16,835)
NECHES RIVER
WELL WATER

Source: Houston Lighting & Power Co.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-8

WATER CONSUMPTION (GPM)
AT
100% PLANT CAPACITY (TWO UNITS)


DISCHARGE
100
160
40
70
20
45
RECYCLE HOLDING POND
pH ADJUSTMENT
FILTER
CLARIFIER
SLUDGE DEWATERING
(NEG)
ENTRAINED WATER LOSS
DISSOLVED AIR FLOATATION
MATERIALS HANDLING AREA RUNOFF
CLARIFIER
CLARIFIER
40 (120)
pH NEUTRALIZATION
160 (380)
A.P.I. OIL/WATER SEPARATOR
70 (500)
20 (100)
SANITARY WASTE TREATMENT
LANDFILL
pH ADJUSTMENT
45 (150)
10
INORGANIC MCW BASIN
CHEMICAL WASTE BASIN
BOILER INCINERATION
5
ORGANIC MCW BASIN
STORMWATER RUNOFF BASIN
70
NEG (200)
160 (380)
FLOOR & EQUIPMENT DRAINS
10
1185
FGD
70
STORMWATER RUNOFF
10
CHEMICAL AREA DRAINS
BOILER BLOWDOWN
CONDENSATE POLISHER
INORGANIC BOILER CLEANING
ORGANIC BOILER CLEANING
55
STEAM SOOT BLOWING
5
5
NEG
10
5
55
SLUDGE STABILIZATION
625
ENTRAINED WATER LOSS
5
LAB DRAINS
BLOWDOWN
EVAPORATION, LEAKAGE & ENTRAINED WATER LOSSES
ECONOMIZER SLUICE
BOTTOM ASH SLUICE
PYRITE SLUICE
175
250 (450)
5 (120)
40 (120)
MAKEUP & CONDENSATE STORAGE
75 (800)
475 (800)
MAKEUP DEMINERALIZER
2000
DEWATERING BIN
TO FLOOR DRAINS
403,600
MAIN CONDENSER
COMPONENT COOLING
10 (35)
115 (800)
FILTERED WATER
5 (20)
MISCELLANEOUS SEAL WATER USE
ASH HANDLING SYSTEM SEAL WATER
175
725 (1250)
20 (60)
6535
170
125 (800)
100
175 (600)
1075
MAIN COOLING TOWER
AUXILIARY COOLING TOWER
FIRE PROTECTION
POTABLE WATER
AIR PREHEATER WASH
BOILER FIRESIDE WASH
CLARIFIED WATER
10
HVAC
MISCELLANEOUS USES
7610
170
340
0
20
10 (2000)
NEG (250)
135
25 (80)
50 (200)
125 (800)
40
1210 (5280)
LEGEND
7440
7780
ONSITE MAKEUP POND
SERVICE WATER
SLUDGE
WATER
9050 (13,120)
NECHES RIVER
WELL WATER

Source : Houston Lighting & Power Co.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-9

WATER CONSUMPTION (GPM)
AT
68% PLANT CAPACITY (TWO UNITS)

in the solubility limits of some chemical compounds in the cooling water being exceeded. These scale-forming compounds can solidify on condenser tubes and decrease plant efficiency by impairing the heat transfer between the condenser tubes and the circulating water. Excessive concentration of chemicals is controlled by removing a small portion of cooling water (blowdown) and replacing it with untreated fresh water. Sulfuric acid is also added to the circulating water to control the pH in a range which prevents the formation of calcium carbonate scale on the surfaces of the main condenser.

The total cooling water usage, including system evaporation (605.67 liters/sec (9,600 gpm)), drift (0.63 liters/sec (10 gpm)), and blowdown (100.31 liters/sec (1,590 gpm)), is 706.62 liters/sec (11,200 gpm). Annual average circulating water system blowdown chemistry is presented in Table 4-6. Due to reusage of blowdown, no wastewater discharge from the cooling towers is anticipated except as necessary for maintenance purposes or during upset conditions.

Auxiliary Cooling Water Systems. The plant also uses a closed cycle auxiliary cooling water system to remove heat from various mechanical equipment in the power plant. Based on the auxiliary cooling water system heat load, approximately 757.09 liters/sec (12,000 gpm) per unit of cooling water is required on a continuous basis. After passage through the equipment, the water is pumped to a wet, mechanical-draft auxiliary cooling tower and reused. Approximately 7.89 liters/sec (125 gpm) evaporation and negligible gpm drift are lost from each unit's auxiliary cooling tower. The operating chemistry of this system differs from the main condenser cooling water system. The cycles of concentration in the auxiliary system are controlled at less than two to avoid using acid for pH control and to limit the buildup of suspended solids in the system. Blowdown from the auxiliary cooling system is used as makeup to the main circulating water system at a flow rate of 7.89 liters/sec (125 gpm) per unit. Total water consumption for auxiliary cooling is 15.77 liters/sec (250 gpm) per unit, 31.55 liters/sec (500 gpm) for the two-unit plant.

Boiler Feedwater. Efficient operation of a boiler at high temperature and pressure requires water virtually free of dissolved and suspended material. Water introduced to the boiler is treated in a makeup demineralizer system to remove dissolved and suspended solids. Trace quantities of chemical substances that pass through the makeup demineralizers, corrosion products in the feedwater system, and dissolved solids introduced by condenser leakage can cause a concentration of solids in the boiler water. This buildup is

TABLE 4-6
ANNUAL AVERAGE CIRCULATING WATER SYSTEM BLOWDOWN CHEMISTRY

Parameter	Average
Calcium	70mg/l
Magnesium	28mg/l
Sodium	168mg/l
Potassium	28mg/l
Bicarbonate	8mg/l
Carbonate	(Insignificant)
Sulfate	259mg/l
Chloride	252mg/l
Silica as Silicon Dioxide	98mg/l
pH	7.6
Total Dissolved Solids	1,008mg/l

controlled by removing a small percentage of the boiler water (blowdown) and by passing the condensate through filter/demineralizer in the boiler feedwater cycle.

The on-site makeup water system consists of two 25.24-liters/sec (400-gpm) parallel process trains employing clarification, filtration, cation, anion and mixed bed demineralization. Approximately 0.63 liters/sec (10 gpm) of demineralized water is required to replace the water lost due to boiler blowdown from both units.

During the conversion of boiler feedwater into steam, dissolved solids present in the feedwater concentrate in the boiler drum. To control this dissolved solids concentration, blowdown is required. The makeup water treatment system also supplies high purity water for the steam soot blowing system (5.05 liters/sec (80 gpm)) and for demineralizer regeneration (340,650 liters/day (90,000 gal/day)).

The condensate filter/demineralizer system consists of three 50-percent powdered resin units which filter suspended solids and remove dissolved solids from the feedwater cycle. Backwash of a filter demineralizer, performed approximately once every three weeks, consumes 24,981 liters (6,600 gal).

Service Water. The service water system is a water distribution system which supplies water for pump seals, floor and equipment washing, and miscellaneous uses. Average service water uses include:

Floor and equipment washes	3.15 liters/sec	(50 gpm)
Makeup demineralizer system	11.04 liters/sec	(175 gpm)
HVAC	1.58 liters/sec	(25 gpm)
Dust suppression	1.58 liters/sec	(25 gpm)
Seal water: (1,485 gpm total)		
FGD pump seals and mist eliminator wash	67.51 liters/sec	(1,070 gpm)
Bottom ash handling system pumps	16.4 liters/sec	(260 gpm)
Circulating water pumps	2.84 liters/sec	(45 gpm)
On-site makeup water pumps	1.8 liters/sec	(30 gpm)
Miscellaneous seal water	4.42 liters/sec	(70 gpm)
Air preheater wash	0.63 liters/sec	(10 gpm)
Boiler fireside wash	(neg.)	(neg.)
	109.46 liters/sec	(1,735 gpm)

Fire Protection. A fire protection water distribution system is provided with outlets located throughout the plant. While periodic flushing of the system is necessary to maintain it in an operable condition, no continuous consumption of water is anticipated from this system.

Potable and Sanitary Water. The potable water distribution system is sized to accommodate approximately 650 operations personnel who will be required for the two units under normal operating conditions. Water from ground-water wells will be chlorinated and used for potable water at a maximum rate of 3.15 liters/sec (50 gpm).

The water is disinfected by chlorine injection and a residual is maintained throughout the distribution system. A potable water storage tank, located in one of tripper galleries, has sufficient hydrostatic head to deliver water to the various plant users. The design of the potable water treatment and distribution system will conform to the "Rules and Regulations for Public Water Systems," Texas Department of Health, 1978.

Bottom Ash Handling System. Bottom ash and pyrites are collected in hoppers and sluiced to a decanting bin. Ash is removed from the decanting bin and trucked to the solid waste disposal area. Water is lost in this system through evaporation of the sluice water and entrainment with the ash and pyrites. Approximately 126.18 liters/sec (2,000 gpm) of recirculating water is in continuous use in the bottom ash handling system for each unit. Makeup water requirements are estimated to be 8.2 liters/sec (130 gpm) per unit, 16.4 liters/sec (260 gpm) for the two-unit plant. This makeup is provided from two sources: the service water used to maintain a water seal between the bottom ash hopper and the boiler and the bottom ash handling system clinker grinder seals. Provisions are also included to use waste treatment system effluents should sufficient demand exist.

The inward overflow seal water is periodically flushed to remove accumulated solids. The excess flush water overflows to the bottom ash hoppers, replacing part of the sluice water lost through evaporation and solids disposal.

Flue Gas Desulfurization (FGD) System. The FGD system uses 50.47 liters/sec (800 gpm) of water per unit for makeup water and 33.75 liters/sec (535 gpm) for pump and agitator seals and mist eliminator wash.

Blowdown from the main condenser cooling water system is suitable for reuse in the FGD process. It is estimated that 50.16 liters/sec (795 gpm) of blowdown water per unit, 100.32 liters/sec (1,590 gpm) for the two-unit plant, will be used. If blowdown is less than 50.16 liters/sec (795 gpm), fresh makeup water is required. To conserve fresh makeup water, blowdown is controlled to balance the FGD makeup requirements. This balance of blowdown and FGD makeup occurs at approximately seven cycles of concentration. Under these conditions, no scale formation is anticipated during normal operation when acid treatment is used to control the pH to approximately 7.8. An additional 0.31 liters/sec (5 gpm) is provided from boiler blowdown.

The 33.75 liters/sec (535 gpm) per unit required for seals and mist eliminator wash is provided from the service water system. This water is recycled into the FGD system process water.

No wastewater is discharged from the FGD system. Makeup to the system is required to replace water lost through both evaporation and sludge disposal.

4.5.1.5 Biocide System

Chlorine is used in plant water systems to control the undesired growth of microorganisms. It is applied in the circulating water system, auxiliary station water system, potable water system, sanitary waste treatment system, station intake structure and water treatment system.

The closed-loop portion of the circulating water system is chlorinated to protect the condenser and cooling tower. Chlorine is added in the circulating water system pump bays and a 1.0 ppm residual maintained at the inlet of the cooling tower. The duration of chlorine application is 30 minutes, twice a day. This schedule has proven to be effective in the control of biological growth in closed-loop cooling systems. It is estimated that the chlorine demand of the circulating water will be approximately 3 ppm. The chlorination system is sized to deliver approximately 6.6 ppm. The program for chlorination of the auxiliary cooling water system is similar to that for the circulating water system.

Chlorination of the water treatment system is used to oxidize a portion of the organic materials in the makeup water and to control fouling in the filters. This requires a continuous chlorine concentration of approximately 4 ppm, with a maximum dosage of 10 ppm available. Residual chlorine is removed from the water treatment system by sodium thiosulfate feed prior to demineralization to protect demineralizer resin from oxidation and degradation.

Chlorination of the potable water and sanitary waste treatment systems requires continuous dosages of 1 ppm and 8 ppm, respectively. Sanitary wastewater will have a minimum residual chlorine of 1.0 ppm after 20 minutes contact time prior to discharge.

Chlorination of the station intake structure is conducted to prevent the growth of bacteria within the piping system and control the corrosion associated with biofouling. Chlorination will be continuous at an estimated dosage of 3 ppm.

Two 3,600-kg/day (8,000-lb/day) chlorinators, one normally operating and one spare, treat the circulating water system by injecting chlorine solution through a diffuser into the circulating water pump bay. Two 225-kg/day (500-lb/day) chlorinators, one normally operating and one spare, treat the auxiliary cooling water system by injecting chlorine solution through a diffuser into the auxiliary cooling water pump bay. One 900-kg/day (2,000-lb/day) chlorinator treats makeup to other plant water systems by injecting chlorine through a diffuser into the bay of the on-site raw water pumps. A spare 900-kg/day (2,000-lb/day) chlorinator is provided. The potable water system uses smaller amounts of chlorine and employs sodium hypochlorite feed pumps and tanks located in the respective chlorine injection area. Sanitary wastewater chlorination is provided by solid tablets containing chlorine which dissolve into the system proportional to flow. The makeup water treatment system employs a 225-kg/day (500-lb/day) chlorinator to inject chlorine into the intake of the makeup water clarifier.

Chlorine injection into the circulating water and auxiliary cooling tower systems is by programmed timer and is alarmed on high chlorine residual, determined by residual chlorine measurements taken at the main condenser outlet and the final auxiliary cooling water heat exchanger, respectively. Chlorination of the station intake structure is by an additive rate controller. Potable water system and sanitary waste treatment system chlorination are continuous with chlorine feed rates controlled by flow.

Chlorine is delivered in a single-unit, 50-metric ton (55-ton) tank rail car. Liquid chlorine will be pumped via underground piping from the rail car to the evaporator on the main cooling tower chlorination skid.

4.5.1.6 Liquid Waste Management System

The liquid waste management system is designed to maximize the reuse of liquid wastes produced at the plant. Most of the liquid wastes are used directly in other systems. Liquid wastes not used directly in other plant systems are collected in the various basins and treated. Effluent from the various treatment systems is either reused or discharged. A total of 116.75 liters/sec (1,850 gpm) is reused while 29.91 liters/sec (475 gpm) is discharged off site during normal operation.

Figure 4-10 illustrates the wastewater sources, the wastewater collection system and the treatment systems. Wastewater is segregated by chemical and physical characteristics and collected in separate basins prior to treatment in six wastewater process streams.

Presented below is a description of the wastewater sources and treatment systems associated with each discharge. Outfall designations are consistent with the existing Texas Department of Water Resources discharge permit.

Outfall 001:

Lignite Storage Pile Runoff. The lignite storage and handling area covers approximately 22.14 ha (54 ac). The area is surrounded by trenches that collect and convey the runoff to the storm water runoff pond. The quality of the untreated lignite pile runoff is expected to be as follows:

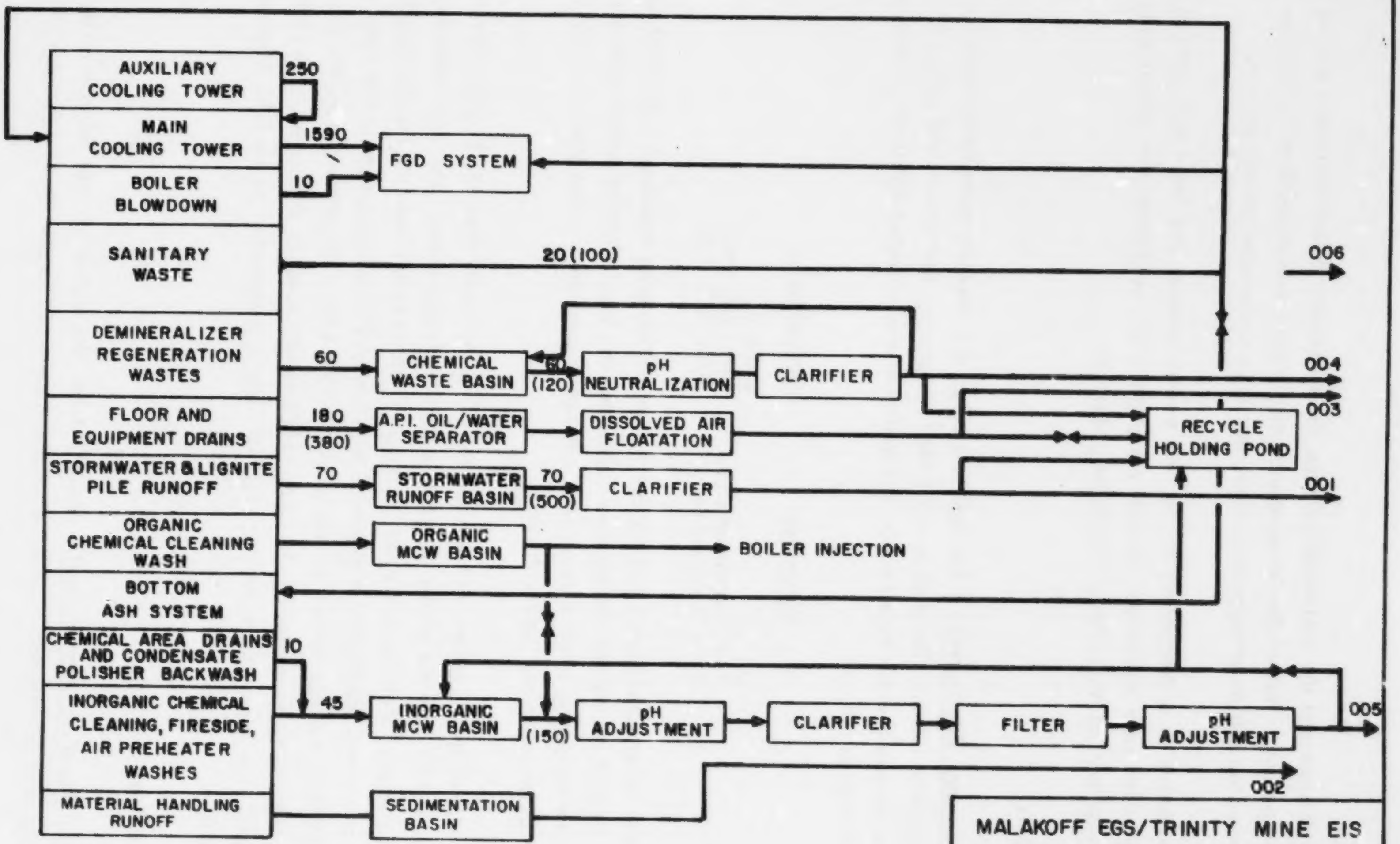
Parameter	Concentration
pH	6.0-8.0
Total Suspended Solids	20-1,200 mg/l
Total Dissolved Solids	100-2,000 mg/l

The storm water runoff basin will collect lignite storage area washdown and runoff, as well as limited volumes of cooling tower blowdown and basin cleaning wastes generated intermittently during plant maintenance and upset conditions. The basin will be of earthen construction and lined with clay.

The collection trench system will be sized to handle the runoff from the 25-year, 24-hour storm event for both the active and reserve lignite storage areas. The 37,471,500-liter (9.9-million gal) runoff basin is sized to contain the total runoff from the the 10-year, 24-hour storm event. Rainwater in excess of the 10-year, 24-hour design storm overflows to the plant site drainage system by way of an overflow weir. The effluent from the storm water runoff basin is treated by clarification and either reused or discharged. The yearly equalized flow from the storm water runoff basin is expected to be 4.42 liters/sec (70 gpm).

Outfall 002:

Material Handling Area Runoff. Runoff from the active portion of the material handling area is collected in runoff ditches and conveyed by pipe from active cells to a


AUXILIARY COOLING TOWER
MAIN COOLING TOWER
BOILER BLOWDOWN
SANITARY WASTE
DEMINERALIZER REGENERATION WASTES
FLOOR AND EQUIPMENT DRAINS
STORMWATER & LIGNITE PILE RUNOFF
ORGANIC CHEMICAL CLEANING WASH
BOTTOM ASH SYSTEM
CHEMICAL AREA DRAINS AND CONDENSATE POLISHER BACKWASH
INORGANIC CHEMICAL CLEANING, FIRESIDE, AIR PREHEATER WASHES
MATERIAL HANDLING RUNOFF
250
1590
10
FGD SYSTEM
20 (100)
006
60
CHEMICAL WASTE BASIN
60
(120)
pH NEUTRALIZATION
CLARIFIER
004
003
180
(380)
A.P.I. OIL/WATER SEPARATOR
DISSOLVED AIR FLOATATION
RECYCLE HOLDING POND
70
STORMWATER RUNOFF BASIN
70
(500)
CLARIFIER
001
ORGANIC MCW BASIN
BOILER INJECTION
10
45
INORGANIC MCW BASIN
(150)
pH ADJUSTMENT
CLARIFIER
FILTER
pH ADJUSTMENT
005
SEDIMENTATION BASIN
002

NOTES:

1. GALLONS PER MINUTE
2. ( ) INDICATES TREATMENT DESIGN FLOW RATE

Source: Houston Lighting & Power Co.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-10

LIQUID WASTE MANAGEMENT SYSTEMS SIMPLIFIED PROCESS SCHEMATIC lined runoff collection pond. The 49,205,000-liter (13-million gal) pond is sized to contain the total runoff from the 10-year, 24-hour storm event plus two years of sludge accumulation. Rainwater in excess of the 10-year, 24-hour design storm overflows to adjacent natural drainage areas via an overflow weir. The active portion of the landfill is minimized to approximately 20.5 ha (50 ac) to minimize contaminated runoff. Collected runoff is treated by sedimentation and discharged. The concentration of suspended solids in the discharge will be less than 50 mg/l, while the total dissolved solids should range from 900 to 3400 mg/l. The annual average runoff flow is expected to be approximately 6.31 liters/sec (100 gpm). A portion of this runoff is reclaimed and used for dust control during periods of dry weather. Runoff from reclaimed portions of the landfill and areas not yet disturbed are uncontaminated and drain via natural drainage channels.

Outfall 003:

Floor Drainage and Oily Wastes. Floor drain and oily wastes consist of oil-contaminated floor drainage, floor washings and equipment leakage from the turbine generator area, the lube oil storage area, and from transformer area and ignition oil tank enclosures. The quantity of wastewater is dependent on plant operation and rainfall. The characteristics of this waste are variable with wide ranges of suspended solids and oil and grease concentrations possible. The average yearly floor drainage and oily waste flow is expected to be 5.68 liters/sec (90 gpm) per unit with a maximum flow of 11.99 liters/sec (190 gpm) per unit.

This wastewater is routed by gravity, where possible, to a 23.97 liters/sec (380 gpm) oily waste treatment system which includes an API separator where oil is removed from the water by gravity. From the tank, the oily waste flows to an air flotation type oil/water separator, where the oil content is further reduced. The quality of the effluent is estimated to be the following:

Parameter	Average Daily	Maximum Monthly
pH	6.0-9.0	6.0[a]-9.0
Total Suspended Solids	0-30 mg/l	100 mg/l
Total oil and grease	0-15 mg/l	20 mg/l

---

[a] Minimum.

Uncontaminated rainfall runoff from grassy areas adjacent to the plant will be directed to the plant yard drain system.

Outfall 004:

Boiler Feedwater System Wastes. Wastes from the water treatment system consist of blowdown from the clarifier, backwash waste from the filters, and regeneration wastes from cation, anion and mixed bed demineralizers.

The makeup demineralizer system design flow rate is 50.47 liters/sec (800 gpm). Water is treated by clarification, gravity filtration and demineralization. The clarifier uses an inorganic coagulant to aid in the removal of suspended solids from the makeup water. The buildup of sludge in the clarifier requires the periodic blowdown of approximately 0.63 liters/sec (10 gpm) of a slurry that consists of 1.0 percent sludge dry weight. All clarifier blowdown is dewatered and disposed in an on-site landfill.

Each of three gravity filters is backwashed once a day at a rate of 126.18 liters/sec (2,000 gpm) for 10 minutes. Filter backwash is expected to contain 500 to 1,000 mg/l total suspended solids (TSS), and is recycled to the clarifier.

Under design flow conditions, the primary cation and anion exchange demineralizers are regenerated once per day. The mixed bed demineralizer is regenerated once per month. Sulfuric acid, sodium hydroxide and demineralized water are used during regeneration of the demineralizers. A total of approximately 340,650 liters (90,000 gal) of wastewater is expected to be produced per day with a pH range of 2 to 12, containing up to 0.5 percent sodium sulfate with lesser concentrations of the constituents present in the makeup water. These wastes are collected in the chemical wastes basin, which is constructed of fiberglass-lined concrete. Mixing is provided by a forced air diffusion system. The basin effluent is neutralized to a pH of 6.0 to 9.0 clarified and either recycled or discharged. Table 4-7 lists the expected effluent quality.

Outfall 005:

Metal Cleaning Wastes. Metal cleaning wastes result from air preheater and furnace wall washes and boiler inorganic and organic chemical cleaning operations. These washes remove solids which originate from the fuel or from metal corrosion. These washes are

TABLE 4-7
MAKEUP DEMINERALIZER REGENERATION WASTES TREATMENT EFFLUENT QUALITY

Parameter	Concentration
pH	6.0-9.0
Total Suspended Solids	30 mg/l
Total Dissolved Solids	7,500-10,000 mg/l
Sulfates	3,000-5,500 mg/l
Chlorides	300-500 mg/l
Alkalinity	500-600 mg/l
Calcium	100-200 mg/l
Magnesium	50-100 mg/l
Soldium	2,000-2,500 mg/l
Silica	200-300 mg/l

required to maintain proper efficiency of the equipment throughout the life of the plant. The expected frequency of each wash and the volume of waste produced from each are listed below:

Wash	Frequency per Unit	Quantity Produced per Wash	
Air preheater	2 per year	5,450,000 liters	(1,440,000 gal)
Furnace walls	2 per year	1,135,500 liters	(300,000 gal)
Organic boiler chemical cleaning	1 per year 2 out of 3 years	6,056,000 liters	(1,600,000 gal)
Inorganic boiler chemical cleaning	Once every third year	9,084,000 liters	(2,400,000 gal)

Water is used to wash the air preheater and the furnace walls.

In the condensate and feedwater system, a chelating solution of ammoniated EDTA is used to remove oils, paints, iron oxide, preservatives and silica in a preoperational wash. These chemicals are circulated at 93.3°C (200°F) for 24 to 48 hours and then displaced by condensate quality water. After flushing, a neutralizer solution consisting of hydrazine and ammonium hydroxide at 93.3°C (200°F) is circulated for two hours and flushed. Passivating solution consisting of a higher concentration of hydrazine at 93.3°C (200°F) is then circulated.

In the preoperational chemical cleaning of the boiler, the alkaline cleaning step using phosphates is similar to the process described above for the condensate and feedwater systems. Inhibited hydrochloric acid with ammonium bifluoride and citric acid is introduced and held at 73.9°C (165°F) for four to six hours to remove iron oxide. After draining, a neutralizer solution of soda ash, sodium nitrite or sodium nitrate is used for two to three hours and drained. Finally, the passivating solution of hydrazine and ammonium hydroxide is used to fill the boiler.

The inorganic wastes produced from these cleaning procedures are segregated from the organic wastes. The organic wastes are collected in a 15,140,000 liters (4 million gal) earthen basin for disposal by boiler injection, where the organic constituents in the wastes are oxidized to carbon dioxide and water. The inorganic wastes are conveyed to a 39,742,500 liters (10.5 million gal) fiberglass-lined concrete inorganic metal cleaning waste basin. Effluent from this basin is treated for the removal of the suspended solids, iron and copper through lime addition, clarification and filtration. The quality of treated metal cleaning waste discharge is presented in Table 4-8.

TABLE 4-8
TREATED METAL CLEANING WASTEWATER EFFLUENT QUALITY

Parameter	Concentration
pH	6.0-9.0
Total Suspended Solids	30mg/l
Total Iron	1 mg/l
Total Copper	1 mg/l
Oil and Grease	15mg/l
Total Dissolved Solids	4,300mg/l
Sulfates	800mg/l
Chlorides	1,700mg/l

Collection and off-site treatment and disposal of chemical cleaning wastes by a licensed, outside contractor may be utilized under circumstances where this option is preferred over on-site treatment.

Condensate Polisher Wastes. The plant steam loop is subject to contamination by suspended and dissolved solids from either condenser tube leakage or metal corrosion. These contaminants are removed in the powdered resin type filter/demineralizer.

As solids collect in the filter/demineralizer, the system requires backwashing of the spent resin. This is expected to occur once every two to three weeks, producing 24,981 liters (6,600 gal) of wastewater. The backwash water is expected to contain 500 to 1,000 mg/l of suspended solids, which are mostly oxides of the metallic components of the feedwater system. The wastewater is pumped to the inorganic metal cleaning waste basin for removal of suspended solids.

Chemical Drainage. Chemical drainage consists of liquids collected in floor drains from the chemistry laboratory, battery room and chemical feed areas (hydrazine, aqua ammonia, sodium phosphate). This waste is pumped to the inorganic metal cleaning waste basin for pH adjustment and removal of suspended solids. The yearly average flow is expected to be 0.63 liters/sec (10 gpm).

Outfall 006:

Sanitary Wastes. During normal operation, sanitary wastes average approximately 1.26 liters/sec (20 gpm), based on a plant staff of 650 using 132.48 liters (35 gal) per capita per day. During construction, a daily maximum of 2,500 people will use both a central toilet facility and portable toilets located in outlying areas of the site.

Wastes from the portable toilets are trucked to the equalization tank, where water is added to dilute the wastewater before treatment. The construction staff uses an estimated 94.63 liters (25 gal) per capita per day, producing an average flow of 2.52 liters/sec (40 gpm). Wastes are treated for control of suspended solids and biochemical oxygen demand and then discharged. Sufficient chlorine is added to assure a 1.0 mg/l chlorine residual after 20 minutes contact time.

4.5.1.7 Solid Waste Management System

Solid wastes produced by the plant consist primarily of fly ash, bottom ash and flue gas desulfurization sludge. Minor quantities of solid wastes are produced from the following sources:

1) Water pretreatment system
2) Inorganic metal cleaning waste treatment system
3) Chemical waste treatment system
4) Floor drainage treatment system
5) Stormwater runoff treatment system
6) Sanitary waste treatment system

FGD sludge and fly ash are combined to form a stablized sludge that is landfilled with bottom ash and sanitary waste sludge in the materials handling area. Water pretreatment system and wastewater treatment system sludges are placed in a separate on-site landfill.

Flue Gas Desulfurization Sludge. The FGD system uses a limestone slurry for sulfur dioxide (SO_2) absorption. The waste resulting from the process is a slurry with a suspended solids concentration of approximately 50 to 55 percent after dewatering. The suspended solids consist of approximately 20 percent calcium sulfate, 60 percent calcium sulfite, 12 percent calcium carbonate, and 8 percent inerts. The quantity of dry FGD sludge that is produced is estimated to be 331,513 metric tons (364,300 tons) per year for both units.

Fly Ash and Economizer Ash. Fly ash is collected by electrostatic precipitators. The estimated quantity of fly ash collected is 799,617 metric tons (878,700 tons) per year, for both units, based on a lignite fuel with an average ash loading of 13.55 kg (30.1 lb) total ash per 292.8 KWh (1 million BTU) and a fly ash to total ash ratio of 70 percent.

The ash is collected dry and pneumatically conveyed to storage silos. The chemical composition of typical Texas lignite fly ash is presented in Table 4-9. Fly ash may also contain trace concentrations of heavy metals present in the lignite.

Bottom Ash. The bottom ash system is a recirculating wet sluice operation which collects bottom ash and pyrites. The total quantity of bottom ash and pyrites produced is

TABLE 4-9
SLUDGE CHARACTERISTICS

Fly Ash and Bottom Ash Chemistry[a]	Percent by Weight
Silicon Dioxide (SiO_2)	25-60%
Calcium Oxide (CaO)	5-25%
Aluminum Oxide (Al_2O_3)	10-20%
Sodium Monoxide (Na_2O)	0.5-5%
Magnesium Oxide (MgO)	2-10%
Sulfur Trioxide (SO_3)	1-10%
Ferric Oxide (Fe_2O_3)	5-15%
Potassium Oxide (K_2O)	0.53%
FGD Sludge Chemistry	**Percent by Weight**
Calcium Sulfate	20%
Calcium Sulfite	60%
Calcium Carbonate	12%
Inerts	8%
Physical Characteristics of Compacted Stabilized Sludge	
Permeability	10^{-6}-10^{-7} cm/sec (1.969×10^{-6}-1.969×10^{-7} ft/min)
Percent Solids	70-85%
Bulk Density	1,285.7-1,687.5 kg/m^3 (80-105 lb/$ft.^3$)

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[a] Jones, B. F. et al., Evaluation of the Physical Stability and Leachability of Flue Gas Cleaning Wastes, Radian Corporation, EPRI FP 671, Vol. 2, 1978.

expected to be 342,706 (dry) metric tons (376,600 tons) per year for both units, based on a lignite with an average ash content of 18.06 percent. Of the 342,706 metric tons (376,600 tons), approximately 76 percent is bottom ash with 24 percent pyrites. The combined wastes are sluiced to dewatering bins to increase the solids content to 70 to 80 percent by weight. The supernatant from the dewatering bins is clarified and recycled to the sluicing system. Bottom ash is trucked to the solid waste disposal area, where it is placed in layers with the FGD sludge. The range of chemical characteristics of typical bottom ash is presented in Table 4-9.

Landfill Operation. FGD sludge will be stabilized with fly ash and/or lime, as required, prior to disposal in the landfill. The stabilized material will be compacted and will harden in place. The ultimate permeability of the material is anticipated to be less than 1×10^{-6} cm/sec (1.969×10^{-6} ft/min). This low permeability will reduce the potential for leachate production when compared to unstabilized FGD sludge. Stabilized sludge also improves the operation of the landfill, since without stabilization the FGD sludge would be thixotropic in nature and more difficult to place, compact, reclaim and handle due to its fluid nature. During normal operation, fly ash which is penumatically conveyed from the precipitator storage hoppers is mixed in a pug mill with dewatered FGD sludge. The FGD sludge is dewatered by the use of thickeners and vacuum filters. From the pug mill, the stabilized mixture is conveyed to a radial stacker and deposited into piles near the plant. Front-end loaders fill 45.5-metric ton (50-ton) trucks, which transport the sludge mixture to the adjacent landfill. At the landfill, it is spread and compacted in 0.61- to 1.22-m (2- to 4-ft) layers. Bottom ash is placed between the layers of stablized FGD sludge. The haulroad from the plant to the materials handling area will be constructed of compacted loose gravel on land that will eventually be used as part of the materials handling area. Bottom ash will be loaded into the 45.5-metric ton (50-ton) trucks from their respective storage bins and transported to the landfill. A truck operation of two shifts per day results in about 155 truck runs per day, five days per week. The volume of compacted sludge produced over the life of the plant is estimated to be 44,405,532 m^3 (36,000 ac-ft) for both units.

The landfill occupies approximately 215.25 ha (525 ac) and is 27.43 to 29.98 m (90 to 95 ft) in height. The side slopes are 3:1. The top of the landfill has a slope of one to two percent so that standing water is minimized. Each year 6.15 ha (15 ac) of land will be developed to the full landfill height. This includes clearing, grubbing, grading and installation of a 0.91-m (3-ft) compacted clay liner or other approved lining material.

The exposed sides and top of a completed cell will be covered with topsoil and seeded. Subsequent cells will be developed into the terraced face of the previous cell.

Design and operation of the landfill minimizes surface water entering the landfill by diverting any water that may enter the area with dikes and culverts. Contaminated runoff is reduced by minimizing the active portion of the landfill to 20.5 ha (50 ac) and by reclaiming filled sections with 0.61 m (2 ft) of topsoil and vegetation. Runoff is collected in runoff channels that are constructed around the active portion of the landfill and treated by settling in a runoff pond and discharged off site. The runoff pond is designed to hold rainfall from the 10-year, 24-hour storm event falling on two landfill cells. Rainfall in excess of the 10-year, 24-hour design storm overflows to the plant site drainage system via an overflow weir. Fugitive dust is controlled by spraying the active portion of the landfill with water when required. The water used in spraying is obtained from the materials handling area runoff pond or the recycle holding pond.

Miscellaneous Sludges. All minor sources of solid waste, except sanitary waste sludge, are landfilled separate from the bottom ash and the FGD pile. Sanitary waste sludge is landfilled with FGD sludge and bottom ash in the stabilized sludge landfill.

Sludge is periodically removed from the organic and inorganic metal cleaning waste basins, lignite pile runoff basin, the chemical waste basin and the recycle holding pond. Major constituents of the sludge from the organic metal cleaning waste basin are iron and copper oxides and residual organic cleaning solution. The sludge from the inorganic metal cleaning basin consists of iron oxides, copper oxides, ash and slag washed from the air preheaters and boiler firesides. The sludge from the storm water runoff basin consists of cooling tower sludges that have been periodically pumped to the basin, consisting of sand and silt collected from the makeup water and lignite fines washed from the piles. The chemical waste basin sludge consists primarily of inorganic salts and the recycle holding pond sludge consists of water treatment sludges. Sludge from these basins is trucked to the separate landfill. Water pretreatment wastes and wastewater treatment wastes, which consist of the various clarifier underflows, are dewatered and also sent to the separate landfill.

The annual quantity of sludge expected from the miscellaneous sources is 925.12 m^3 (0.75 ac-ft) from the combined clarifier underflows after dewatering and 2,590.32 m^3 (2.1 ac-ft) from cleanout of the various basins. The miscellaneous sludge landfill will be developed in 0.05- to 0.10-ha (0.125- to 0.25-ac) cells per year. The landfill when completed will cover about 2.1 to 2.9 ha (5 to 7 ac) on a side slope of 3:1 with final height of 4.57 to 6.1 m (15 to 20 ft). The landfill will be constructed with a 0.91-m (3-ft) compacted clay liner. Runoff from this landfill will be collected in a lined evaporation pond. Excess water which may accumulate in the pond during heavy rains will be either pumped or trucked to the inorganic metal cleaning waste treatment system for treatment and discharge.

Sludges from the miscellaneous sludge landfill will be tested for their suitability for stabilized disposal with the FGD sludge and bottom ash. Should the combined sludge prove not to be a hazardous waste under State and Federal laws, and the structural characteristics of mixed wastes appear satisfactory, co-disposal may be adopted.

4.5.1.8 Atmospheric Emission Control Systems

Particulate Removal. The particulate removal system selected for the Malakoff EGS is an electrostatic precipitator. Electrostatic precipitators use an array of parallel grounded plates (the collecting electrodes) and discharge electrodes mounted in a plane midway between the plates to induce a static charge upon the particulate matter. The particles are charged by the electrical field created between the discharge and collecting electrodes. Particulate matter collects on the plates and is dislodged by rapping. Dislodged particles fall into an ash storage hopper for subsequent removal and disposal. Fly ash disposal is discussed in Sec. 4.5.1.7.

In this application, the design removal efficiency for the precipitator is 99.95 percent, with a flue gas flow of 7.1×10^4 actual cubic meters per minute (2.5×10^6 ACFM) at maximum continuous rating, a fly ash loading of 181,440 kg (403,200 lb)/hr and a design temperature of 143.3°C (290°F). Particulate emissions comply with the NSPS for fossil fuel steam electric generating facilities of .014 kg particulate/292.8 kWh fired (0.03 lb/10^6 BTU).

Flue Gas Desulfurization System. A wet limestone flue gas desulfurization system has been selected to control sulfur oxides emissions from the Malakoff EGS. The FGD system has a design removal efficiency of 90 percent, with a flue gas flow of 7.1×10^4 actual cubic meters per minute (2.5×10^6 ACFM), a design temperature of 143°C (290°F) and an SO_2 loading of 3.6 kg per 292.8 KWh (8 lb per million BTU). In this system, flue gas is distributed to absorber modules where it is cooled to saturation temperature and contacts droplets of reagent solution. The principal chemical reactions removing the SO_2 from the flue gas take place in the absorber module and in recycle tanks, which recirculates a portion of the limestone slurry for reuse. The primary waste products are calcium sulfite and calcium sulfate. A mist eliminator system in the absorber tower removes entrained slurry droplets prior to reheating.

To maintain fresh limestone reagent in the absorber, spent limestone solution is removed and replaced by fresh solution. The waste stream is a 10 to 15 percent solids slurry which is thickened to 30 percent. Thickener overflow is recycled to the absorber. Thickener underflow is sent to a vacuum filter for further dewatering before transfer to the sludge stabilization system.

The saturated flue gas exits the absorber module at approximately 54.4-60°C (130-140°F) and is heated to approximately 71.1-76.7°C (160-170°F) to minimize acid condensation and protect downstream equipment. The flue gas leaves the top of the absorbers and flows in a common duct to a reheat mixing plenum wherein it is combined with hot air from the reheater and varying amounts of bypassed flue gas. Hot air reheat is accomplished by passing ambient air over hot water heated tubes by air blowers and then injecting the heated air into the reheat mixing plenum. Hot air injection requirements, and therefore hot water requirements are based on the quantity of flue gas being bypassed, the boiler load and the FGD inlet SO_2 loading.

The FGD system is designed to treat the full flue gas flow. A portion of the flue gas can bypass the FGD absorber modules and mix with the treated flue gas. This approach allows plant operation during emergency conditions and reduces heat requirements when burning low sulfur coal. The NSPS allows this approach if a spare module is provided in the FGD system.

Stack Design. After treatment in the particulate removal and FGD systems, exhaust gases are vented to a reinforced concrete stack with a freestanding acid-resistant brick liner extending the full height of the concrete shell. The height of the stack is 190.5 m (625 ft), with a top inside diameter of 8.4 m (27.5 ft). Stack gas exit velocity is 22.0 m/sec (72 ft/sec) at MCR. The stack is designed in accordance with guidelines established by the American Concrete Institute. An annulus area is provided between the stack liner and the stack shell to enable operating personnel to maintain stack monitoring and lighting equipment. A clean, safe working environment is maintained by pressurization of the annulus area, which prevents infiltration of flue gas through the liner.

Four sampling ports are provided in the stack at a 90 degree spacing. To ensure a measuring location where flue gas is evenly distributed through a cross section of the stack, the ports will be located eight stack diameters above the duct breeching entrance. Each port has provisions for insertion of a sampling probe. Additional sampling points are provided for mounting an opacity analyzer and continuous flue gas monitoring equipment. The continuous gas analysis system monitors SO_2, NO_x, opacity and CO_2 (or O_2) for compliance with the NSPS (1979).

To provide a warning to low-flying aircraft, four high intensity white strobe lights are installed at the top of the stack, four at the level of the emission sampling ports and four at an elevation one-third the height of the stack. The lighting design complies with applicable Federal Aviation Administration (FAA) regulations.

4.5.1.9 Electrical System

Generator. The generators convert mechanical energy from the steam turbine to electrical power. The generating unit is connected to the low voltage terminals of the main power transformer by an isolated phase bus duct. The generators are 3-phase, 3600 rpm, 60 Hz, hydrogen and water cooled, with excitation system, excitation breaker, voltage regulator and surge protection capacitors.

Main Power Transformer. The power generated is stepped up to 345-kv by the main power transformer. Power is transmitted from the main power transformer to the plant switchyard by means of high-voltage transmission lines. The main power transformer is pad mounted, and is equipped with a conservator tank with an oil preservation system. No polychorinated biphenyls (PCBs) are used in this transformer or in any other station transformer.

Four on-site transmission lines will be required between the plant switchyard and power plant. Two 138-kv lines will energize the standby auxiliary transformers required for startup. The power produced by the generators will be routed to the switchyard over the two 345-kv lines.

Switchyard. The switchyard will distribute power generated by the units to transmission circuits of the HL&P system. The switchyard is 345/138 kv, complete with auto transformers, power circuit breakers, switches, switchyard busses, structures, towers, lightning arrestors, auxiliary and essential power supply equipment, and a control house containing transmission line breaker controls and relaying equipment. Any large power transformer installed within the switchyard will be placed in an oil retention pit.

Standby Auxiliary Transformers. Two standby auxiliary transformers are installed with Unit 1. These transformers provide the electrical power required for initial startup of the unit. Once the unit is operating at partial load, the plant auxiliary equipment power load is transferred to the unit auxiliary transformers. The standby auxiliary transformers then remain as an emergency backup for the Unit 1 and Unit 2 unit auxiliary transformers. The standby auxiliary transformers are also utilized for the startup of Unit 2.

Unit Auxiliary Transformers. A portion of the power from the generator terminals is used to energize the plant auxiliary equipment via the two unit auxiliary transformers. These transformers supply power to all the plant auxiliaries while the unit is operating under normal conditions.

Transformer Drainage System. A drainage system is provided for each outdoor mineral oil-filled transformer. The transformer is placed in a reinforced concrete pit, which is covered by grating. The pit is sized to contain the transformer oil, plus a minimum of 0.3 m (1 ft) of freeboard, should a rupture of the transformer tank occur. A minimum of 0.91 m (3 ft) is maintained between the transformer oil container and the concrete curb. Each pit is also equipped with a drain sized to carry the full flow of the fire protection deluge system directly to the plant oily waste treatment unit. In the event of a tank rupture, there will be no off-site discharge of oil-contaminated wastewater.

Transmission Facilities. Four 3-phase, 345 kv, 1300 MVA circuits will be located on two double circuit steel towers. These transmission lines will begin at the switchyard and extend northward approximately 3.7 km (2.3 mi) to the proposed Forest Grove-Trinidad transmission line. Approximately 1.3 km (0.8 mi) of the transmission lines will be located within the boundaries of the Malakoff EGS site. The remaining 2.4 km (1.5 mi) will occupy a 91.4-m wide (300-ft wide) corridor. These circuits will, in effect, electrically tie the Malakoff EGS to ERCOT's transmission grid, negating the requirement to construct some 322 km (200 mi) of 345 kv transmission to the HL&P service area.

4.5.2 Mine Systems and Operating Characteristics

A discussion of the alternative mining methods is presented in Sec. 4.4.2.1. The preferred alternative for mining the project lignite reserves is surface mining. The following sections describe this preferred alternative.

4.5.2.1 Mineable Reserves

Total in-place lignite reserves are approximately 295,750,000 metric tons (325,000,000 tons). Total lignite recovery using best available technology is presently estimated to be 225,680,000 metric tons (248,000,000 tons).

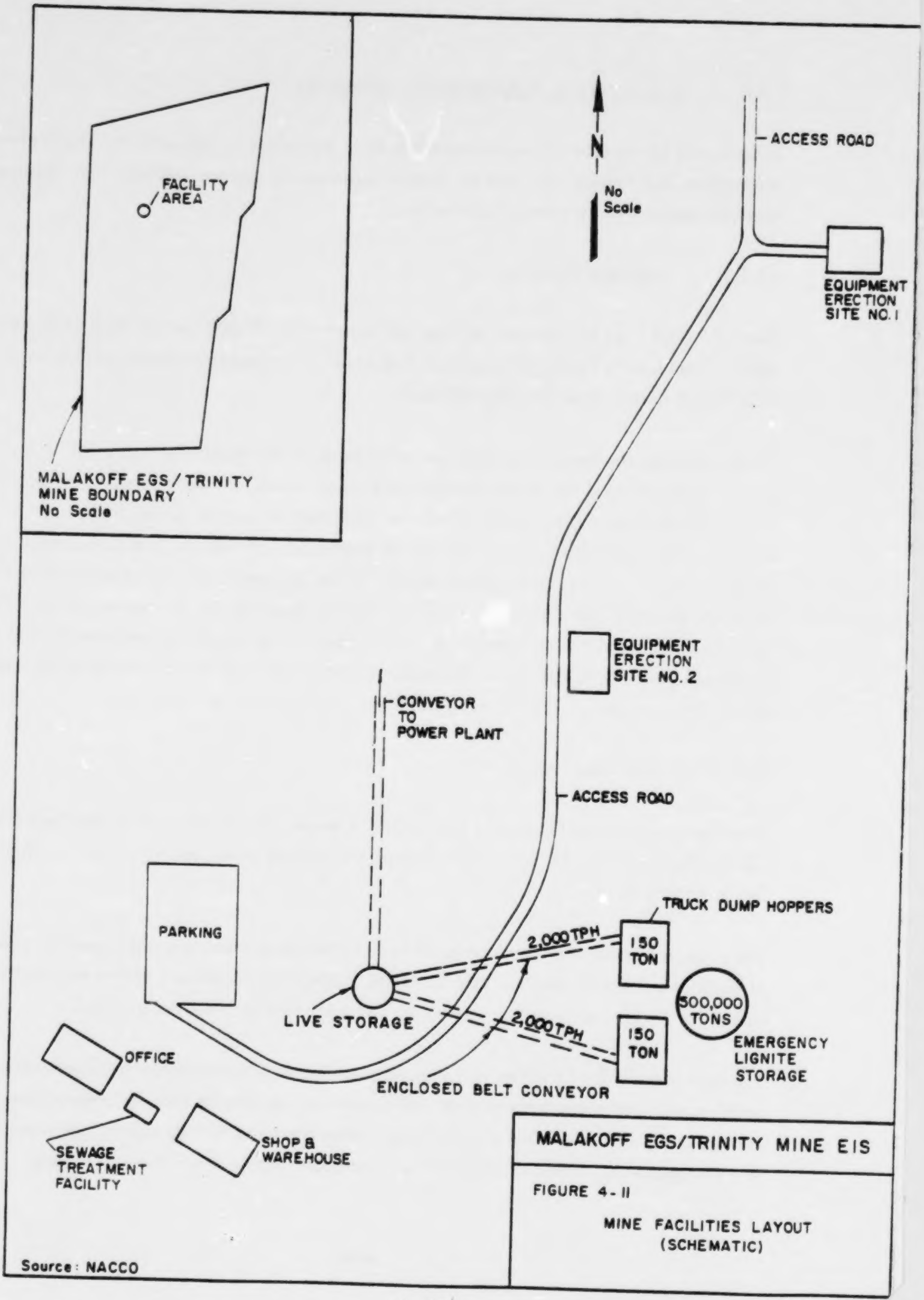
The project lignite deposit contains numerous beds of lignite of which at least nine major seams, being of mineable thickness (0.6 m (2 ft) or more), are considered to be economically recoverable. The regional dip of the lignite seams is to the southeast at approximately one-half degree. The lignite seams undulate locally and the dip may be as steep as eight degrees in localized areas. Since all seams are not present in any one location, the mine plan generally calls for mining fewer seams at any one time. Texas lignite within the Wilcox Formation generally has heating values ranging from 3.41 to 5.09 Kwh/kg (5,300 to 7,900 BTU/lb). The weighted mean value for the mineable Wilcox lignite seams is approximately 4.12 Kwh/kg (6,400 BTU/lb) on an as-received basis.

4.5.2.2 Facilities Layout

Mine facilities will be located in four separate areas: two for equipment erection; one for lignite handling; and the other for storage, permanent mine personnel and maintenance facilities (Fig. 4-11).

The proposed equipment erection sites include an access road, a graded area for erection of draglines, a warehouse and shop building, trailers for temporary office and bathhouse, parking areas for equipment and vehicles, and sufficient provision of utilities.

The permanent mine facilities will include an office with bathhouse, a shop and warehouse building, parking areas for equipment and vehicles, an outside storage area, a diked fuel storage area, a fueling area, a truck hopper with breaker and conveyor to the lignite coal live storage area. Another conveyor will transport lignite from the live storage area to


FACILITY AREA
MALAKOFF EGS/TRINITY MINE BOUNDARY
No Scale
N
No Scale
ACCESS ROAD
EQUIPMENT ERECTION SITE NO. 1
EQUIPMENT ERECTION SITE NO. 2
CONVEYOR TO POWER PLANT
ACCESS ROAD
TRUCK DUMP HOPPERS
PARKING
2,000 TPH
150 TON
150 TON
500,000 TONS
LIVE STORAGE
2,000 TPH
EMERGENCY LIGNITE STORAGE
OFFICE
ENCLOSED BELT CONVEYOR
SEWAGE TREATMENT FACILITY
SHOP & WAREHOUSE

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-11

MINE FACILITIES LAYOUT (SCHEMATIC)

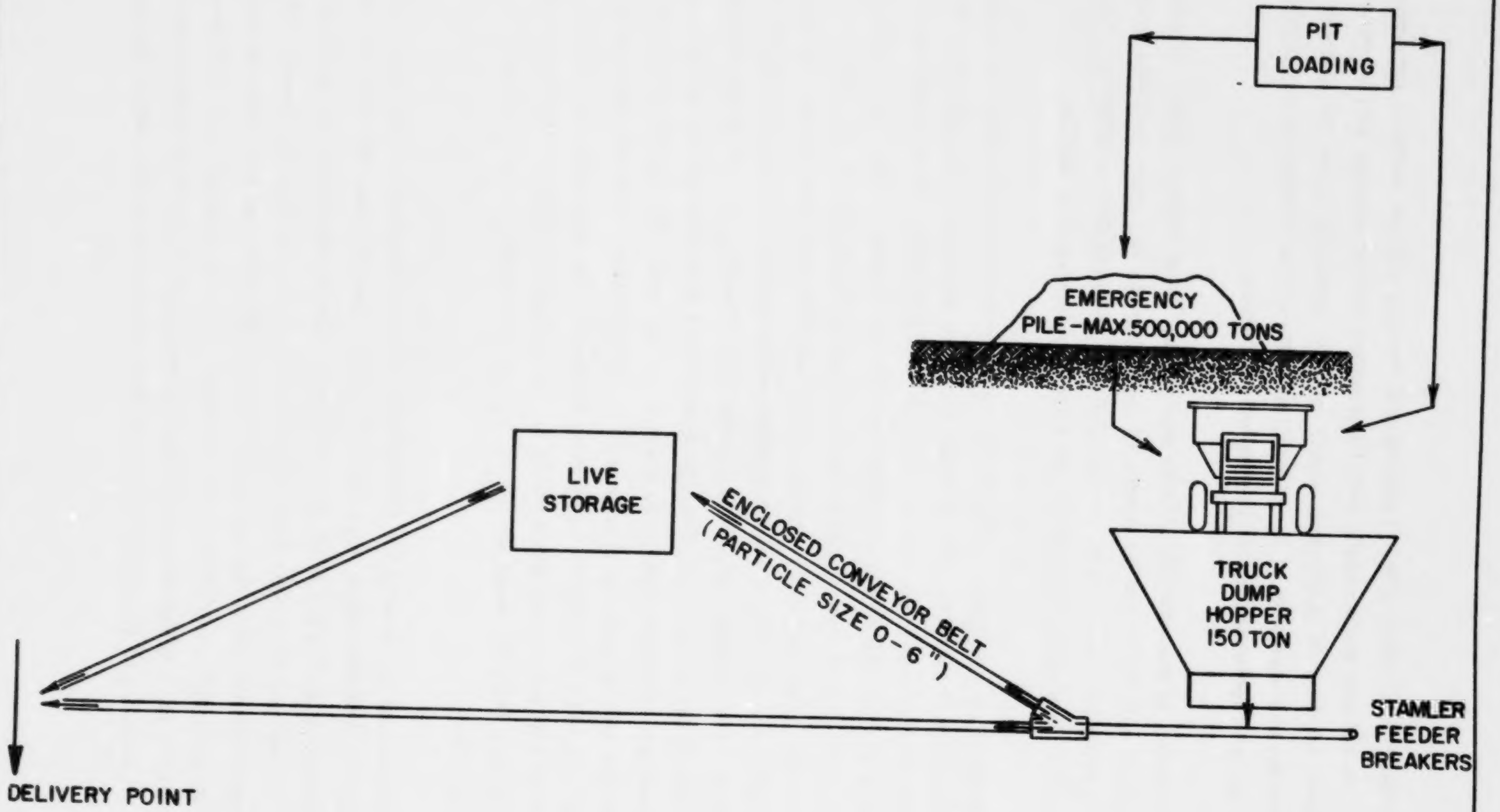
Source: NACCO

the Malakoff EGS plant site. Lighting and fencing will be installed for security and safety. A potable water supply will be provided and all sewage will be treated in a treatment facility to applicable water quality standards prior to discharge. The construction and operation of these facilities will meet or exceed all applicable mining, safety, environmental and building codes and regulations.

Electric power to the mine site is to be provided by Texas Power & Light Company. Mine distribution will be routed by means of pole lines to the mine facilities area, to the dragline erection areas, and to within 1,800 to 2,400 m (6,000 to 8,000 ft) of the active mining pits. Trailing cables will provide further transmission to the pits.

Lignite Handling Facilities. The lignite handling facilities will consist of a truck dump, coal breakers, conveyors, live storage area and emergency storage pile. The lignite handling facility will have a total capability of 3,640 metric tons (4,000 tons) per hour. Standard 91- or 109-metric ton (100- or 120-ton) bottom dump haul trucks will dump lignite into one of two hoppers, each having a 136.5-metric ton (150-ton) capacity (Fig. 4-12). Spray bars at the hopper will be used for dust suppression. The coal will fall by gravity into one of two feeder breakers which consist of chain conveyors and lignite breakers. The breakers crush the lignite from run-of-mine size to the required (0- to 15.24-cm (0- to 6-in.)) size. The lignite will move from the breaker onto one of two 3/4 enclosed belt conveyors leading to the live storage area. The lignite will move downward in the live storage area by gravity onto a belt conveyor. The live storage area will be fitted with dust suppression equipment at the lignite entry and exit points. The belt conveyor will run to the Malakoff EGS. An emergency storage lignite pile of 455,000 metric tons (500,000 tons) of lignite will be maintained in order to provide a backup lignite source.

Routine use of the emergency storage pile is not anticipated and the maximum expected capacity is 455,000 metric tons (500,000 tons). Reclaim from this pile will be taken by mobile equipment to the truck dump hoppers. Lignite received at the truck dump hoppers will be reduced to a less than 15.2-cm (6-in.) particle size by feeder breakers, and conveyed directly from the truck dump to the customer's delivery point or to live storage via covered belt conveyors. All conveyors will be covered with 3/4 covers. Dust suppression for fugitive dust control will be employed at the truck dump receiving hoppers and all downstream transfer points in the form of spray bars using water, as required.


PIT LOADING
EMERGENCY PILE-MAX.500,000 TONS
TRUCK DUMP HOPPER 150 TON
STAMLER FEEDER BREAKERS
ENCLOSED CONVEYOR BELT (PARTICLE SIZE 0-6")
LIVE STORAGE
DELIVERY POINT

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-12

LIGNITE FLOW DIAGRAM
(SCHEMATIC)

No Scale
Source: NACCO

The entire lignite handling facilities area will encompass approximately 20.5 ha (50 ac). The various components of the system as described are shown on Fig. 4-12 and listed as follows:

1) Truck haulage from the mine pits.

2) Emergency storage pile adjacent to the truck dump.

3) Truck dump station.

4) Conveyor transport from the truck dump directly to the customer's delivery point or to live storage, and from live storage to customer's delivery point.

5) Live storage.

Items 1 through 4 are expected to be the most expedient and effective manner of handling the lignite and no alternatives are proposed. Item 5, live storage capacity, is undetermined at this time, pending a final determination of surge capacity requirements to meet the power plant's delivery demands. The following three live storage systems are proposed for the given range of storage capacities.

For 10,000- to 20,000-ton Storage. For requirements in this range, a concrete silo will be utilized for live storage. Lignite will be received at the top of silo and moved downward by gravity and fed into a belt conveyor for transport to the power plant. Based upon historical experience, the concrete silo is the most effective means of live storage for handling capacities in this range. Dust suppression will be accomplished by means of spray bars or collection systems at the silo entrance and exit points.

For 20,000- to 45,000-ton Storage. For requirements in this range, a covered "glory hole" will be utilized for live storage. The glory hole is an inverted cone for the lower half of the pile, constructed by partial excavation and then earth-filled to form the inverted cone portion. The top half of the pile will be a conical pile configuration, covered with a dome or conical roof structure. Lignite will enter the dome at the top and moved downward by gravity through the inverted cone area and fed into the conveyor belt. The glory hole is the most effective means of storage for handling capacity requirements in this range. Dust suppression will be accomplished by spray bars or collection systems at the material entrance and exit points.

For 60,000- to 400,000-ton Storage. For storage requirements in excess of 60,000-ton capacity, an open-type stockpile will be utilized for live storage. The type of handling equipment will be a stacker/reclaimer system. The stacker/reclaimer will traverse the length of the pile on rails, stacking the lignite to either side with a boom stackout. The piles will be reclaimed by use of a bucket wheel reclaimer. The bucket wheel will be located on the same stackout boom, and will tranverse the length of the pile reclaiming lignite from either side. The stacker/reclaimer is the most effective system for storage capacities in this range. Dust suppression will be achieved by the use of spray bars at the point of stacker discharge, and at the point of contact between the lignite and the bucket wheel reclaimer.

4.5.2.3 Mining Sequence

The mining sequence in Fig. 4-13 was developed to provide the design tonnage rate for the power plant units. The mining sequence was developed under the following criteria and assumptions:

1) Mining will be in accordance with applicable current State and Federal surface mining, discharge, air quality, safety and other environmental regulations.

2) Mining will begin in shallow overburden areas and progress toward deeper overburden areas. Figure 4-13 identifies, by mine block year, pit orientation and pit progression. Mine blocks referenced with no year identifier are included to allow for future expansions of the mine.

3) Mine equipment units will be added as necessary to meet lignite tonnage requirements. Mine block letters A through D represent mine equipment units.

4) Recovery of the lignite deposit will be at maximum.

5) Length of haulroads and electrical transmission lines will be minimized.

6) Appropriate alternative overburden removal systems as discussed in Sec. 4.4.2.2 will be utilized.

7) Areas will be mined where depth of seams is generally less than 45.7 m (150 ft) for the first 35 years of operation.

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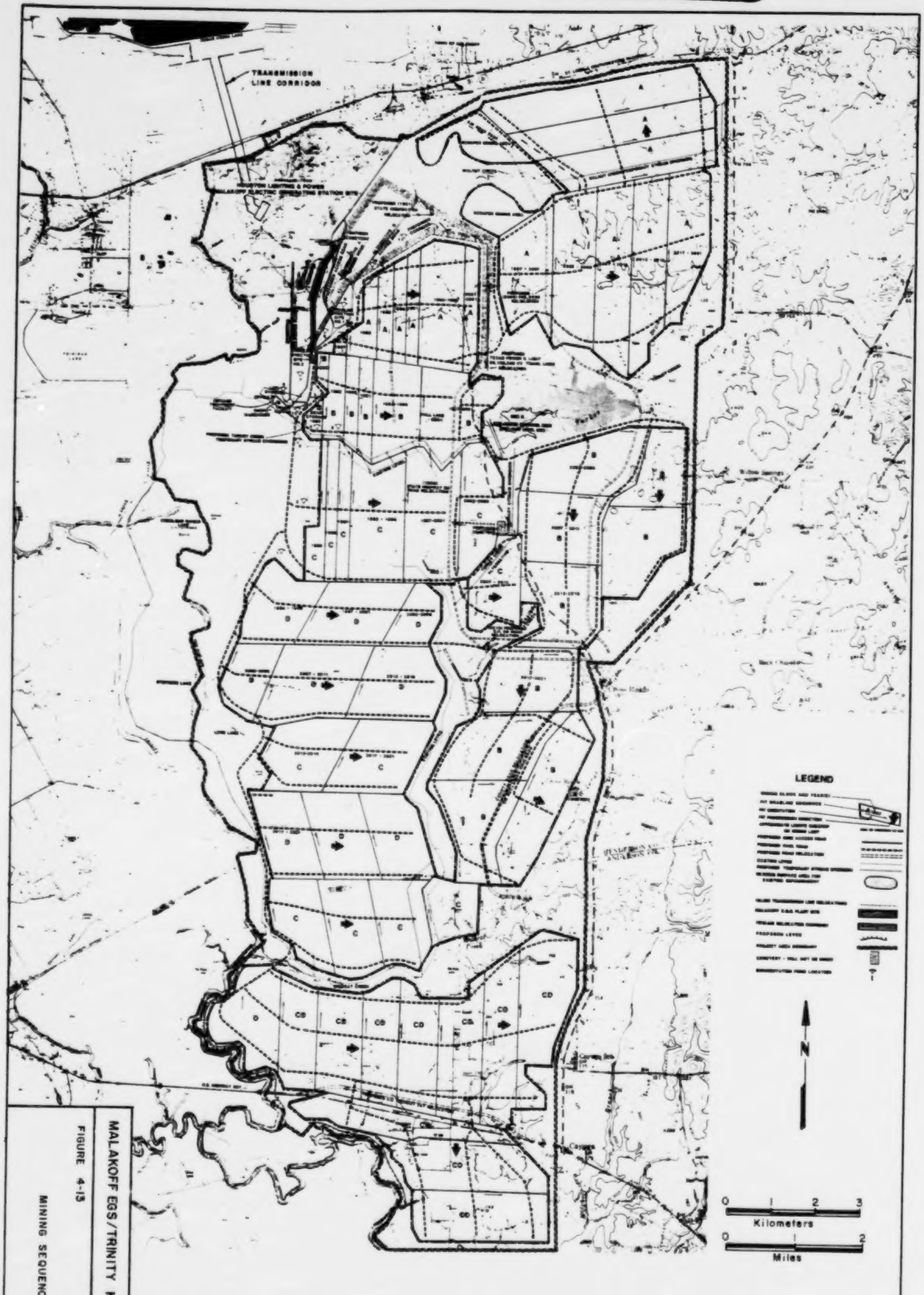

TRANSMISSION LINE CORRIDOR
A
B
C
D
CD
LEGEND
N
0 1 2 3
Kilometers
0 1 2
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-13

MINING SEQUENCE

SOURCE: NASCO

NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES.

8) Modification of the existing flood control structures will be minimized and flood control at all times in the project area will be maintained.

9) Lands scheduled for mining will be acquired by lease or purchase prior to mining.

Proposed mine facilities, roads, levees, stream diversions, pipeline and power line relocations as well as the Malakoff EGS site are also identified on Fig. 4-13. The mining sequence presented is subject to modification based upon changes in the criteria and assumptions listed above.

4.5.2.4 Mining Methods and Equipment

The following sections describe the preferred alteratives for the surface mining operation. Land clearing, drainage and erosion control, diversion and rerouting of streams, flood protection levee maintenance and construction, control of surface water and ground water, mine-related road construction and maintenance, overburden handling, lignite removal and transportation, and reclamation/revegetation operations are discussed. Mining, as presently contemplated, will commence in areas of shallow overburden (northwestern portion) and proceed toward areas of deeper cover (southeastern portion). A total of 15,621 surface ha (38,100 surface ac) of the project is available for lignite mining. The current requirement for lignite supply for the Malakoff EGS will involve mining 8,774 surface ha (21,400 surface ac). If a market becomes available at some future date during the life of the project, additional lignite may be mined to recover the majority of the available resource.

Over the proposed 35-year life of the project, an average of 250.5 surface ha (611 surface ac) will be mined each year. Land reclamation operations will begin with mining operations and continue through a complete soil reconstruction and revegetation sequence. Considering the area cleared prior to mining the active pit area and the area of ungraded overburden, a total of 410 ha (1,000 ac) may be disturbed at any one point in time.

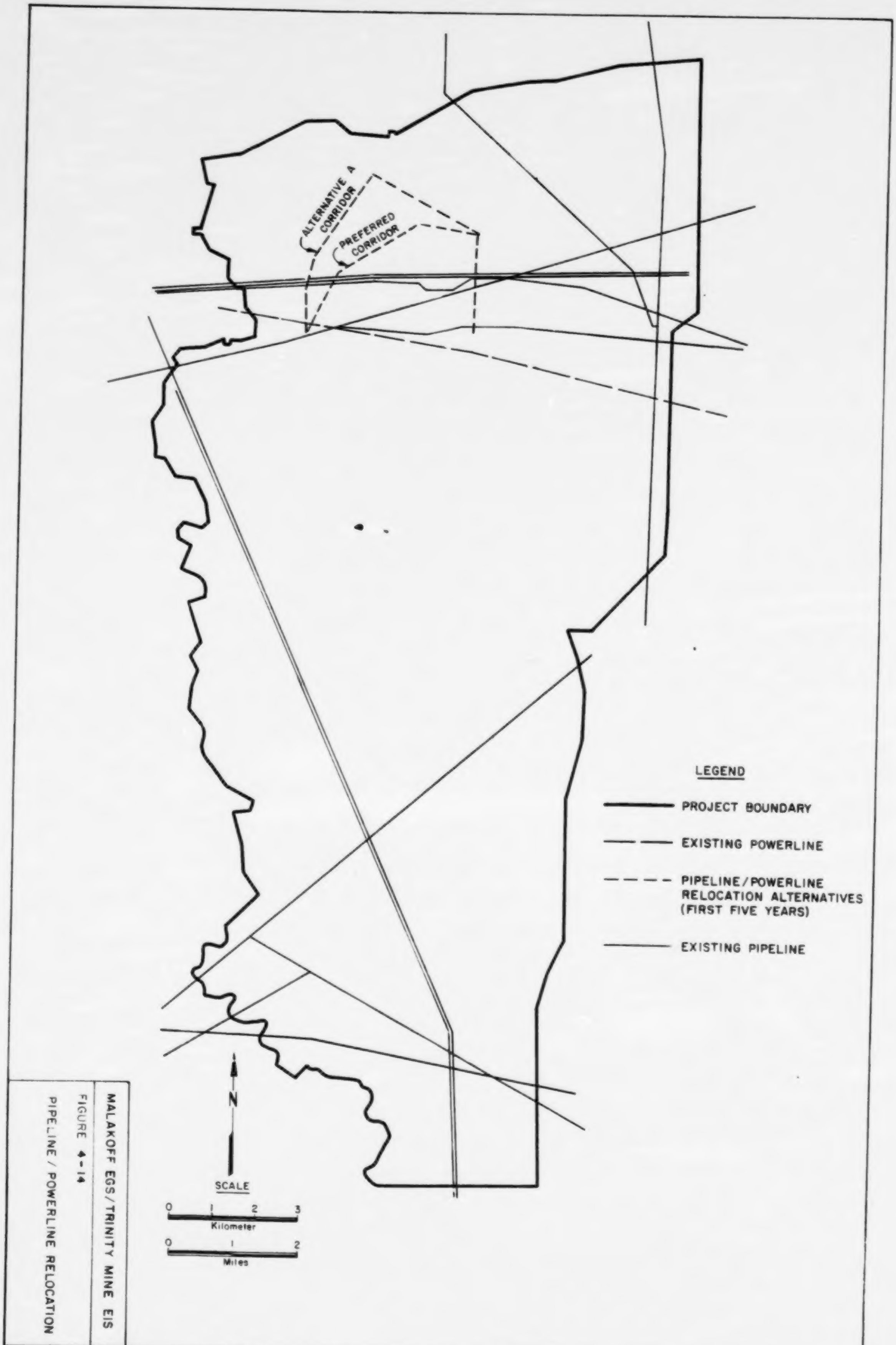
Pipeline-Powerline Relocations. Various pipeline and powerlines which currently cross the mine property will be relocated during the life of the mine. The relocations will be required to allow the recovery of lignite resource under and adjacent to these encumbrances. Figure 4-13 shows existing power lines and the proposed initial relocations. Pipeline relocations are shown on Fig. 4-14.

The preferred corridor for initial relocations is approximately 8,534.4 m (28,000 ft) in length and covers approximately 106.6 ha (260 ac). The existing 69, 138 and 345 kv power transmission lines and five pipelines will utilize this corridor, and the width of disturbance will vary from 61 to 152.4 m (200 to 500 ft) depending on the number of lines present at a given location. This preferred location is the shortest and most cost effective routing for these lines.

An alternative is considered in the event current exploratory drilling indicates that mineable lignite resource extend north into the preferred location. In this event, the relocation corridor will extend to the north as delineated and allow full utilization of the resource. Alternative A will extend for approximately 10,058 m (33,000 ft) and encompass an area of approximately 134.9 ha (329 ac).

In addition to the five pipelines initially relocated, a maximum of eight additional relocations will be required over the life of the mine. The specific route of these relocations will be determined in detail, as the particular time sequencing of the mine pits becomes available. All relocations will be designed to provide the least overall impact consistent with prudent engineering practice. In all cases, particular attention will be given to environmentally sensitive areas. The diversion or impoundment of any natural waters will be accomplished in such a manner to reduce or eliminate any impact on aquatic life. All mobile equipment will utilize mats where necessary to protect sensitive ground conditions, and any other measures as may be deemed appropriate will be incorporated to diminish impact of the relocations, in accordance with 33 CFR Part 330.6 as published on July 22, 1982 as Interim Final Rules for the Regulatory Programs of the Corps of Engineers.

Land Clearing. Land clearing activities will occur in advance of and in conjunction with overburden removal. It is anticipated that, in general, land clearing will occur 90 to 180 m (300 to 600 ft) in advance of overburden removal. The rate of land clearing and distance ahead of the active mining operation will be affected to some extent by weather conditions and overburden removal methods. Brush and timber will be salvaged wherever and whenever practical. Remaining vegetation may be bulldozed and/or disposed of by burning and/or burial in accordance with applicable air, waste disposal and surface mining


ALTERNATIVE A CORRIDOR
PREFERRED CORRIDOR
LEGEND
PROJECT BOUNDARY
EXISTING POWERLINE
PIPELINE/POWERLINE RELOCATION ALTERNATIVES (FIRST FIVE YEARS)
EXISTING PIPELINE
N
SCALE
0
1
2
3
Kilometer
0
1
2
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 4-14

PIPELINE / POWERLINE RELOCATION

regulations. The cleared area will be leveled for mining equipment operating at the surface. Surface-water runoff will be diverted around the cleared areas through the use of ditches and berms. Runoff from cleared areas will be pumped and/or channeled to sedimentation ponds.

Drainage and Erosion Control. Drainage and erosion control for the project mine must be in compliance with Sections 339, 340, 344, 345, 346 and 347 of the Texas Coal Mining Regulations (Railroad Commission of Texas, 1981).

Drainage will be controlled by ditching and use of sedimentation filters, ponds and structures in accordance with the sections identified above. Erosion will be controlled by minimizing the area to be disturbed, bank stabilization, revegetation and sedimentation filters, ponds and structures.

A total of 13 discharge points will be authorized under the NPDES permit for the initial five-year period. Basic data on these 13 outfalls are as follows:

Outfalls 001-012

Locations:	discharge points from sedimentation ponds
Sources:	001 - facilities area runoff and treated domestic wastewater (from Outfall 101); 002 - dragline erection site runoff and disturbed mining area runoff; 003 through 012 - disturbed mining area runoff.
Flow Characteristics:	intermittent
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	35.0mg/L	70.0mg/L
Total Iron	3.0mg/L	6.0mg/L
Total Manganese	2.0mg/L	4.0mg/L

In addition, pH of the effluents must fall within the range of 6.0-9.0. Discharges resulting from precipitation within a 24-hour period less than or equal to the 10-year, 24-hour precipitation event may comply with an effluent limitation for settleable solids of 0.5 mL/L (daily maximum) instead of the otherwise applicable limitations. If the 10-year, 24-hour precipitation is exceeded, only the pH limitation (6.0-9.0) is applicable. The 0.5 mL/L limitation on settleable solids (daily maximum) also applies to discharges from reclamation areas until performance bond is released.

Outfall 101

Location: discharge point from wastewater treatment plant, upstream of sedimentation pond with Outfall 001.

Source: domestic wastewater

Effluent Limitations:

Parameter	Daily Avg.	Daily Max.
Biochemical Oxygen Demand	0.5 Kg/day (1 lb/day)	0.9 Kg/day (2 lb/day)
Total Suspended Solids	0.5 Kg/day (1 lb/day)	0.9 Kg/day (2 lb/day)

Mine construction and operations activities will be in compliance with all other current State and Federal environmental safety rules. Should the rules covering drainage and erosion control be modified at some future date, the coal mine operator will comply with all such modifications.

Diversion and Rerouting of Streams. Diversion and rerouting of streams may occur during the mining process. Figure 4-13 identifies locations for stream reroutes and diversions. Reroutes and diversions of streams will be in accordance with the Texas Coal Mining Regulations, Sections 341 and 342 (Railroad Commission of Texas, 1981).

Final design specifications for all planned stream diversions and reroutes will be presented to the Railroad Commission of Texas for their approval prior to construction. Depending on the site and nature of the diversion and/or reroute, other State and Federal agencies which may be involved in the permitting approval and/or consultation process are:

1) The Texas Department of Water Resources
2) The U.S. Army Corps of Engineers
3) The U.S. Environmental Protection Agency
4) The USDA Soil Conservation Service
5) The Henderson County Levee Improvement District

Modifications of existing laws and rules covering the diversion and reroute of streams may require the modification of the plans as presented.

Flood Protection Levees. The locations of existing flood protection levees for the project area are identified in Fig. 4-13. These levees were constructed in the 1920s by the Henderson County Levee Improvement District and have an excellent history of providing flood protection. The Trinity River levee is referred to as the western section of the levee which protects the pre-existing flood plain from flooding by the Trinity River. The hillside levee is referred to as that portion of the levee which diverts overland flow around the pre-existing flood plain. During mining, flood protection will be provided through the maintenance of the existing levee system. No disturbance of the Trinity River levee is contemplated. Where the hillside portion of the levee is mined, either a temporary levee or permanent reroute of the levee will be constructed. Any modification to the existing hillside levee will be accomplished in a manner such that flood protection is continuous.

In addition to the proposed modifications to the hillside levee, construction of a short levee section is proposed to protect a portion of the southwestern section of the mine area from the river (Fig. 4-13). The construction of this levee section will be required to mine the lignite resource currently unprotected from flooding. Once mining is completed, this new levee may or may not be retained subject to approval of various regulatory agencies involved in the permitting of new levee construction.

Approvals, permits and/or consultation for construction or modification to the levees and floodwater retarding structures will be required with one or more of the following agencies: Railroad Commission of Texas; U. S. Army Corps of Engineers; Texas Department of Water Resources; USDA Soil Conservation Service; and the Henderson County Levee Improvement District.

Control of Overland Flow. Overland surface-water flow in areas disturbed by mining will be controlled by ditches and berms. Surface-water runoff collected in ditches will be directed to sedimentation basins for treatment and release. The control of overland flow and the discharge associated with the control are regulated by: Railroad Commission of Texas, Surface Mining Division; Texas Department of Water Resources; and U. S. Environmental Protection Agency.

Future modification of existing rules regarding the control of overland surface-water flow may require modification of the proposed control plan.

Control of Ground Water. Water which collects in the active mine pit may be from two sources. Rainfall and ground-water seepage water which collects in the pits will be directed to sumps and pumped to the surface and into the surface-water control systems. In order to maintain highwall slope stability in portions of the mine, it may be necessary to install wells or well points in advance of mining to dewater and stabilize overburden for mining. Highwall seepage rates were estimated (Depts. of the Army, Navy and Air Force, 1971) and yields from Wilcox sediments were computed to range between 24 and 73 gpm per 1,000 ft of highwall for boxcut situations.

A seepage rate in the alluvial material was estimated to be approximately 1,400 gpm per 1,000 ft of highwall for boxcut situations.

The Texas Coal Mining Regulations address protection measures required for ground water. The North American Coal Corporation, as mine operator, must abide by these rules and by modifications thereto. The specific sections include 348, 349, 350 and 351 (Railroad Commission of Texas, 1981).

Mine Access Road Alternatives. The main entrance road to the mine facilities area will provide access for all vehicular traffic. The majority of traffic will be mine employees traveling to and from work, and in addition, visitor traffic and delivery of mine equipment and supplies. A preferred location and two alternatives are proposed, with certain characteristics common to all three. The common characteristics are road construction, width of disturbance and typical road construction. The width disturbance will be an average of 15.2 m (50 ft) along the majority of its length with the roadway centerline generally following the right-of-way centerline.

Roadway design for all alternatives considered will be of the typical secondary roadway type with a base course and asphalt wear surface. Road width will be 7.3 m (24 ft) wide and crowned to provide drainage. Total width of disturbance including drainage will be 15.2 m (50 ft).

All roadway design, construction and reclamation will meet or exceed the design criteria for Class II roads as defined in the January 1, 1981 Railroad Commission of Texas Coal Mining Regulations, Sections 407 through 413.

These criteria will produce a road embankment that will be stable, safe and erosion-resistant in both cut and fill sections. Disturbance to the area in terms of erosion, siltation, ground cover removal, air and water pollution will be minimized with the proper design of this road. The road will be reclaimed to original ground contour and revegetated after mining is finished in accordance with Section 413 of the RRC Regulations, unless otherwise approved.

The preferred mine access road location is shown on Fig. 4-13. It will begin at a point north of Antioch Cemetery, joining with the existing HL&P/U.F.I. access road planned from Farm-to-Market Road 90 to the U.F.I. facilities. From this point, the road will continue in a southerly direction toward the mine facilities site maintaining an approximately minimum profile grade elevation of 88.4 m (290 ft) msl, including a bridge crossing Walnut Creek. Approaches to the creek bridge will consist of earth fill on each side, and approximately 152.4 m (500 ft) of concrete bridge structure centered over the main channel floor. The bridge and adjacent structures, at a minimum, will be designed and constructed in accordance with the Railroad Commission of Texas Coal Mining Regulations, Section 410, which will require safe passage of the 100-year, 24-hour flood. Drainage structures shall not affect the normal flow or gradient of the stream or adversely affect fish migration or aquatic habitat values or related environmental values.

The general impact of the mine access road will be confined to the road width of disturbance along its length, a total distance of 4,450 m (14,600 ft) encompassing approximately 7.0 ha (17 ac). The portion of land to be disturbed or cleared will be kept to a minimum.

This location is preferred because it provides convenient access between the mine facilities and the U.F.I. facilities, and is overall felt to be the most cost effective design. Costs associated with the roadway, constructed by U.F.I./HL&P and utilized in part by Trinity Mine, would be assessed to Trinity Mine on a one-third basis.

Alternative A is depicted on Fig. 4-13. This location will coincide with the preferred location up to a point approximately 610 m (2,000 ft) south of the U.F.I./HL&P road departure. This design would swing the road in an easterly direction north of the designated wetlands area to avoid crossing that area. The total length of this alternate would be 4,450 m (14,600 ft), and will encompass a total area of 7.0 ha (17 ac). This alternative will require a bridge structure crossing Walnut Creek similar to the preferred location, and in addition, will require larger quantities of cut/fill and additional drainage crossings on the southeastern side of the creek. For this reason, Alternative A will be more expensive than the preferred location, and is second in choice.

Alternative B is depicted on Fig. 4-13. It will begin at a point joining Farm-to-Market Road 90, approximately 2.4 km (1.5 mi) south of Highway 31, just south of the Farm-to-Market Road 90 Walnut Creek Bridge. The road will proceed from Farm-to-Market Road 90, along the southeastern side of the Walnut Creek valley at an elevation equal to or greater than 88.4 m (290 ft) msl. This alternative will be 5,547 m (18,200 ft) in length and encompass approximately 8.6 ha (21 ac) of disturbed area.

A major cost of this alternate route will be the base of potential reserves under the road. Potentially mineable reserves rendered unrecoverable by the alternative are 728,000 metric tons (800,000 tons). The base of these reserves dictates Alternative B to be the third choice.

All road construction will be conducted in such a manner as to cause a minimum impact to the environment. All water impoundments, diversions or other activities within any wetlands areas will be avoided or minimized to reduce or eliminate any adverse impact. Whenever required, equipment will be operated on mats. All construction and design activities will be conducted in a prudent manner, in accordance with 33 CFR Part 330.6 as published on July 22, 1981 as Interim Final Rules for the Regulatory Programs of the Corps of Engineers.

Haulroad Construction and Maintenance. Locations of proposed haulroads are given in Fig. 4-13. Construction and maintenance of haulroads are strictly regulated by the Railroad Commission of Texas (1981), Texas Coal Mining Regulations performance standards Sections 400 through 420, which apply to the construction, use and maintenance of roads. The mining company's only alternative is to construct roads in accordance with these rules.

Equipment Alternatives. Once the land has been cleared, overburden removal operations will begin. Approximately 250.5 surface ha (611 surface ac) of land will be mined each year during the 35-year life of the project. Land reclamation operations will begin with mining operations and continue though a complete soil reconstruction and revegetation sequence. The total area of unrevegetated land involved in mining at any one time is not expected to exceed 410 ha (1,000 ac). This equates to 2.0 percent of the total 22,222-ha (54,200-ac).

Section 4.4.2.2 presents the overburden handling alternatives available for operation. The preferred alternative is to use a combination of the alternatives. The currently planned approach entails segregating the reserve field into two distinct areas. These areas are separated by the upper levee system. The upland area, that area upstream of the upper levee, is planned to be mined by a dragline operation. The area below the upper levee, which is essentially the old Trinity River flood plain, has three possible mining scenarios available. The first scenario includes a dragline operation whereby the dragline will chopcut the alluvial material while sitting on the top of the Wilcox. This same dragline will also remove the Wilcox material. This scenario does not lend itself to the recovery of the sand and gravel present in this area. The second and third scenarios use a bucket wheel excavator to remove the alluvial material. In these scenarios, the sand and/or gravel deposits can be readily recovered. The only difference between these two scenarios is a dragline would remove the remainder of the overburden (the Wilcox) in one and a BWE would remove the remaining overburden in the other. Second order mine and reclamation studies and design programs are in progress to determine the best application for this area.

Lignite Handling Facilities Alternatives. All run-of-mine lignite will be transported from the pits in standard 91- or 109-metric ton (100- or 120-ton) bottom dump coal haulers. The run-of-mine lignite will be delivered to a truck dump facility where it will be unloaded into the truck dump hoppers or into an adjacent emergency stockpile if the truck dump is not operational. This pile will be formed by direct unloading from the haul trucks. The pile will be maintained by compacting with mobile equipment and wetting with water trucks.

Routine use of the emergency storage pile is not anticipated and the maximum expected capacity is 455,000 metric tons (500,000 tons). Reclaim from this pile will be taken by mobile equipment to the truck dump hoppers. Lignite received at the truck dump hoppers will be reduced to a less than 15.2-cm (6-in.) particle size by feeder breakers, and conveyed directly from the truck dump to the customer's delivery point or to live storage via covered belt conveyors. All conveyors will be covered with 3/4 covers. Dust suppression for fugitive dust control will be employed at the truck dump receiving hoppers and all downstream transfer points in the form of spray bars using water, as required.

The entire lignite handling facilities area will encompass approximately 20.5 ha (50 ac). The various components of the system as described are shown on Fig. 4-12 and listed as follows:

1) Truck haulage from the mine pits.

2) Emergency storage pile adjacent to the truck dump.

3) Truck dump station.

4) Conveyor transport from the truck dump directly to the customer's delivery point or to live storage, and from live storage to customer's delivery point.

5) Live storage.

Items 1 through 4 are expected to be the most expedient and effective manner of handling the lignite and no alternatives are proposed. Item 5, live storage capacity, is undetermined at this time, pending a final determination of surge capacity requirements to meet the power plant's delivery demands. The following three live storage systems are proposed for the given range of storage capacities.

For 10,000- to 20,000-ton Storage. For requirements in this range, a concrete silo will be utilized for live storage. Lignite will be received at the top of silo and moved downward by gravity and fed into a belt conveyor for transport to the power plant. Based upon historical experience, the concrete silo is the most effective means of live storage for handling capacities in this range. Dust suppression will be accomplished by means of spray bars or collection systems at the silo entrance and exit points.

For 20,000- to 45,000-ton Storage. For requirements in this range, a covered "glory hole" will be utilized for live storage. The glory hole is an inverted cone for the lower half of the pile, constructed by partial excavation and then earth-filled to form the inverted cone portion. The top half of the pile will be a conical pile configuration, covered with a dome or conical roof structure. Lignite will enter the dome at the top and moved downward by gravity through the inverted cone area and fed into the conveyor belt. The glory hole is the most effective means of storage for handling capacity requirements in this range. Dust suppression will be accomplished by spray bars or collection systems at the material entrance and exit points.

For 60,000- to 400,000-ton Storage. For storage requirements in excess of 60,000-ton capacity, an open-type stockpile will be utilized for live storage. The type of handling equipment will be a stacker/reclaimer system. The stacker/reclaimer will traverse the length of the pile on rails, stacking the lignite to either side with a boom stackout. The piles will be reclaimed by use of a bucket wheel reclaimer. The bucket wheel will be located on the same stackout boom, and will tranverse the length of the pile reclaiming lignite from either side. The stacker/reclaimer is the most effective system for storage capacities in this range. Dust suppression will be achieved by the use of spray bars and wetting agents at the point of stacker discharge, and at the point of contact between the lignite and the bucket wheel reclaimer.

Reclamation and Revegetation. Reclamation operations for the Trinity Mine will be designed and field tested such that the preferred operations will generate new soils that meet the RRC reclamation performance standards. The applicable RRC reclamation performance standard for surface lignite mining operations is found in the Texas Coal Mining Regulations. The performance standard requires the operator to "restore the land affected to a condition capable of supporting the uses that it was capable of supporting prior to any mining, or to higher or better uses of which there is a reasonable likelihood, . . ." (Sec. 23(b)(2)) (Texas Surface Coal Mining and Reclamation Act).

Texas regulations allow considerable flexibility regarding soil reconstruction methods. The methods of soil reconstruction range from: 1) complete segregation of individual soil horizons: A, B and C; 2) partial segregation and blending of individual soil horizons, e.g., A and a combination of B and C horizons; 3) complete to partial segregation of the A horizon only; 4) segregation and placement of select overburden zones; 5) completely mixing the overburden; and/or 6) some combination of methods 1) through 5). However, regardless of the soil reconstruction method(s) to be employed, the operator is required to demonstrate that the soil reconstruction method(s) will generate new soils which meet the capability performance standards of the Act and the regulations.

Field experiments are required by the RRC in order to demonstrate reclamation success for specific reclamation method(s). Consequently, NACCO constructed a soil reconstruction field experiment during the spring of 1982. The experiment is designed to evaluate the feasibility of using: 1) mixed upland overburden; and 2) mixed alluvial overburden (alluvium) as a top soil (A horizon) and subsoil (B and C horizons) substitute material. This is one of the three alternatives under consideration by NACCO.

The soil substitution potential for these soil reconstruction methods is based upon three factors: 1) overburden handling costs; 2) the agronomically based potential to restore the soil medium to a condition capable of supporting ground cover and at least 90 percent of the pre-mining productivity levels; and 3) the projected cost savings gained by interfacing overburden removal (production operation) and phase one soil reconstruction operations into one efficient step.

Reclamation and revegetation operations will progress according to the following sequence:

1) phase one: soil reconstruction;
2) phase two: soil reconstruction and establishment of temporary vegetation;
3) establishment of permanent vegetative cover; and
4) vegetative management: extended responsibility period.

Phase one soil reconstruction operations involve handling and placement and final surface contour grading operations required to reconstruct the new soil, potentially from:

1) randomly mixed overburden;
2) segregation of the weathered zone; and/or
3) topsoil (A horizon) segregation.

Phase two soil reconstruction operations include measures known to improve the physical condition of surface soil material. Principally, this soil reconstruction phase involves production and incorporation of crop dry matter residues into the reconstructed soil surface. During this phase, vegetative species will be planted which: 1) produce greater levels of dry matter than the permanent vegetation; 2) produce an initial supply of high N (nitrogen) containing residues; and 3) produce both deep roots and numerous near-surface fibrous roots. Agronomic research shows that incorporation of select dry matter residues should improve the physical condition of the soil material with respect to water movement, air diffusion and the microbiological community.

Establishment of the permanent vegetative cover will meet the RRC requirements for postmining land use (Section 399). Vegetation maintenance of permanent species must reflect cost equivalent management levels for undisturbed soils. Maintenance of the permanent vegetation will continue until the RRC releases the operator from all management responsibilities. Beginning with phase one soil reconstruction operations, the anticipated reclamation period schedule is approximately 10 years. This reclamation period represents one complete mining soil reconstruction and revegetation sequence. An approximate chronological order of the anticipated reclamation sequence is as follows:

1) year one: land preparation in advance of mining, mining and phase one soil reconstruction;
2) year two: phase one soil reconstruction finalization and initiation of phase two soil reconstruction;
3) year three: phase two soil reconstruction;
4) year four: phase two soil reconstruction;
5) year five: establishment of permanent vegetation; and
6) years six through ten: management of vegetation during extended responsibility period and obtainment of final regulatory release from management responsibilities.

Reclamation and revegetation equipment for phase one soil reconstruction operations will include draglines, dozers and possibly scrapers. Reclamation and revegetation equipment for phase two soil reconstruction, revegetation and maintenance operations is designed to support soil reconstruction and revegetation operations associated with a surface mining advancement rate of approximately 250.5 ha (611 ac) per year. Contractor reclamation operators may be used intermittently during the reclamation sequence.

Operator performance and reclamation success are controlled by the RRC through a bond system. Subchapter J of the Texas Coal Mining Regulations, particularly Sections 301, 304, 306, 308, 312 and 313, identify the State's bonding criteria for filing performance bonds through the bond release phase (Railroad Commission of Texas, 1981).

4.6 ALTERNATIVES AVAILABLE TO EPA

Three alternatives are available to EPA regarding its permit action: 1) issue the NPDES permit as proposed; 2) issue the NPDES permit with certain conditions; or 3) deny the NPDES permit. The issuance of the NPDES permit as proposed would allow HL&P to construct and operate the electric generating station and would allow NACCO to construct and operate the mining facilities as described in Sec. 4.5 and to discharge wastewater to the limits set forth in the permit. However, EPA may determine that special conditions should be added to the NPDES permit where necessary to minimize or avoid adverse environmental impacts. Also, EPA may deny the NPDES permit if certain environmental considerations are significantly adversely impacted and mitigation measures are unacceptable. Denial of the NPDES permit by EPA could cause HL&P and NACCO to redesign the project for no effluent discharge or pursue the no action alternative.

4.7 ALTERNATIVES AVAILABLE TO OTHER PERMITTING AGENCIES

The USCE may require Section 404 permits for certain activities occurring within waters of the United States including adjacent wetlands. The overall review of the Section 404 permit applications for this project, including the environmental documentation, is the responsibility of the Fort Worth District USCE. Each application is evaluated to determine the probable impact the project will have on the public interests with particular emphasis given to water quality. Alternatives available to USCE include: 1) approval; 2) approval with conditions or modifications; or 3) disapproval.

Other agencies having review and/or permitting responsibilities are: Railroad Commission of Texas, Texas Department of Water Resources; Texas Air Control Board; State Historic Preservation Officer; Texas Parks and Wildlife Department; U. S. Fish and Wildlife Service; and USDA Soil Conservation Service.

5.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

5.1 TOPOGRAPHY

5.1.1 Existing Environment

The Malakoff EGS/Trinity Mine Project area is situated within the Sandy Hills region of the Gulf Coastal Plains physiographic province. The project area can be further divided based upon two distinct land form types. The flat, low-lying terrain of the Trinity River flood plain characterizes the west-central and southern portions of the project area, while the remainder of the project area is characterized by an upland rolling plain dissected by intermittent and ephemeral tributaries of the Trinity River. Ground surface elevations within the project area range from 75.8 m (250 ft) msl in the Trinity River flood plain to over 121.3 m (400 ft) msl in the northwestern portion of the site area.

5.1.2 Impacts of No Action Alternative

No significant adverse or beneficial impacts to topography will result from the no action alternative. Sand and gravel mining operations would continue which would locally affect topography, since currently no regulations require reclamation of sand and gravel mining operations.

5.1.3 Impacts of Project Alternatives

5.1.3.1 Impacts of Construction

Power Station. Construction of the power station and associated facilities will result in a general overall leveling of approximately 426.4 ha (1,066 ac) of the plant site topography. No significant, adverse impacts to topography will occur as a result of power station construction.

Mine. Construction of mine facilities (i.e., shop, dragline erection pads, haul roads, etc.) will involve the disturbance of a relatively small area (116 ha (283 ac)) when compared to the total area of the mine site, and will result in some alteration to localized topographic relief with minimal impact.

5.1.3.2 Impacts of Operation

Power Station. Operation of the power station will result in a localized impact to the topography associated with the solid waste disposal practices. The landfill will occupy about 215 ha (525 ac) and will involve a total increase in elevation over the project lifetime of 27 to 29 m (90 to 95 ft).

Mine. Topography will experience local, short-term, adverse impacts resulting from the mining of specific blocks. These impacts will be mitigated by leveling and regrading operations during reclamation. It is expected that one to two years will be necessary to regrade the mined areas, and reclamation activities will be conducted concurrently with mining of new blocks. The reclamation practices will involve reshaping the mined surface to a configuration similar to premining topography, and the removal of sedimentation ponds constructed on graded surfaces after they are no longer required, if they are not permitted to remain.

Overburden materials which will be removed during mining operations are texturally similar to the material presently existing in the upper 3.0 to 4.6 m (10 to 15 ft). Therefore, mixing of the materials and the resulting occurrence of textural dissimilarities (which can oftentimes trigger short-term subsidence) will be negligible in the cast overburden, making the potential for significant subsidence also negligible. In addition, overburden which is removed and then replaced during the mining process commonly undergoes an initial bulking or swell due to increases in voids and air introduced into the materials. Industrial estimates of this initial swell of the replaced overburden, immediately after placement by the mine equipment, is about 20 percent, and investigations by Schneider (1977) found maximum initial bulkings of 24 to 47 percent.

Settlement and redensification occurs rapidly over the first few weeks and months of placement, with generally 75 percent of total settlement occurring in the first year (Schneider, 1977; Rangel, 1979). The values of settlement a few years after mining are in the range of 0.03 to 0.06 m (0.100 to 0.200 ft) per year. Ten years after mining, the land will show virtually no settlement. At this point, the volume of the overburden replaced will have a residual swell of from 7 to 23 percent above its natural volume (Schneider, 1977).

This final volume including swell will serve to replace the volume of lignite mined. The net effect will be dependent on the thickness and composition of overburden encountered, lignite seam(s) thickness, and the mining method used.

To determine net effects on the general ground surface elevations in the area, several geologic drill holes were evaluated by NACCO to determine the effect of lignite removal and overburden swell. A final net swell value of 10 percent was chosen to be representative of the overburden materials at the Trinity Mine. The upland areas of the mine with overburden depths of approximately 29.0 to 45.7 m (95 to 150 ft) showed changes in potential ground surface elevation ranging from a decrease of 0.18 m (0.6 ft) to an increase of 2.88 m (9.54 ft) with an overall average increase of 1.31 m (4.3 ft) in ground surface elevation.

The alluvial areas of the interior levee watersheds were evaluated in the same manner with 10 percent net swell applied. Due to the thinner overburden cover in these areas (9.1 to 32.0 m (30 to 105 ft)), the effect was generally a net decrease in ground surface elevation. The elevation changes ranged from a 0.18-m (0.6-ft) increase to a 1.42-m (4.65-ft) decrease in ground surface elevation, with an average net decrease of 0.49 m (1.62 ft) in elevation.

The potential for more extensive mining of gravel also exists in the alluvial areas, due to the availability of gravel in the area. Gravel mining is already present in these areas and producing the effects described. The effect of removal of an assumed 1.52-m (5-ft) layer of gravel was also analyzed (with a swell of 10 percent applied to remaining overburden). This was analyzed to investigate effects produced if the proposed lignite mining activity or a future mining activity would seek to recover this resource.

The removal of both lignite and the gravel resource would create a net decrease in ground surface elevation ranging from 1.49 to 2.74 m (4.9 to 9.0 ft). The average decrease in ground surface elevation was 2.24 m (7.35 ft).

The maximum slope variations which possibly may occur are estimated from a maximum increase in elevation of 2.88 m (9.54 ft) in the upland areas to a maximum decrease in the alluvial areas of 2.74 m (9.0 ft) separated by a minimal distance of about 12.8 km (42,000 ft) for a maximum post-mine slope of 0.46 percent. This value, when compared to the premine slope of 0.42 percent between these areas, is considered to result in a negligible impact to topography.

Viewed in the context of the overall relief of the area, the changes of elevations of these magnitudes will not result in significant, adverse impacts to topography, but the impact will be long term in nature. The total relief for the area is generally from 24.4 to 30.5 m (80 to 100 ft) from hill crest to valley floor. This should be compared to the maximum changes indicated (±2.74 m (±9 ft) maximum) and the average of net increase or decrease (average increase = 1.31 m (4.3 ft); decrease = 0.49 m (1.62 ft) without gravel mining, or average decrease = 2.24 m (7.35 ft) with gravel mining and lignite mining).

Schneider (1977) suggests that differential settlement of mine spoils has the potential to create a problem in two instances. He states the need for investigation to be conducted on the performance of a conventional slab foundation built on reclaimed land, and the rate of redensification as it is affected by changes in soil moisture associated with the construction of roads or foundations. He further states that measured differential settlement of 0.100 ft/yr over 350 ft is not a major problem for the construction of roads or utilities. He also states that if further research shows that conventional slab foundations do not adequately perform on mine spoils, differential settlement can be designed for when constructing rigid structures. He adds that design solutions could increase the construction cost.

Schneider (1977) concluded that "reclaimed land could be open for real estate development within a reasonable time after mining and that no major problems should be encountered due to settlement providing suitable building techniques are employed."

5.2 SOILS

5.2.1 Existing Environment

The proposed mine area comprises about 22,222 ha (54,200 ac) of soils within Henderson and Anderson counties. The power station site consists of about 1,390 ha (3,400 ac), all within Henderson County. Basic data used in the description of the existing soils environment were taken from the published soil surveys of Henderson County (USDA, 1979) and Anderson County (USDA, 1975). Map unit descriptions and productivity figures for crops and pasture, rangeland and woodland may be found in those documents. They also contain information on wildlife habitat, soil engineering properties, selected soil chemical and physical properties and local soil-forming processes.

The location of soil map units within the proposed mine and power station areas is presented in Fig. 5-1. Also shown is the location of prime farmland soils as defined by the SCS in Section 657.56 of the Federal Register, Vol. 43, No. 21, Tuesday, January 31, 1978, commonly referred to as SCS prime farmland. These criteria for prime farmland soils do not consider the cropping history of the soils in question, which is one of the criteria used by the Railroad Commission of Texas to define prime farmland. Prime farmland is discussed in Sec. 5.3.

Table 5-1 summarizes, by county, the acreage and percent of soil mapping units within the proposed mine boundary. It also shows the acreage and percent of prime farmland soils as defined by the SCS. Similar information for the proposed power station is given in Table 5-2.

Within the proposed mine boundary, there are approximately 21,840 ha (53,267 ac) of relatively undisturbed soils, about 108 ha (263 ac) of gravel pits (as of January 1974) and about 176 ha (429 ac) of water, e.g., stock tanks, watershed control structures, water-filled pits, etc.

Table 5-3 illustrates the wide range of soil characteristics within the proposed mine area. In general, the upland soils are highly weathered and most of them are acid, at least in the surface layers. For the most part, they are low in natural fertility, thus, require fertilizer and lime in a high level of management. The bottomlands, for the most part, have loamy soils along local streams. Clay soils, less acid in nature, are found along bottomlands of the Trinity River. Table 5-3 illustrates that soils within the proposed mine boundary can be placed into six major groups, in which the soils of each group have similar characteristics and limitations. A seventh group is composed of miscellaneous land types and water.

Soils of the proposed power station site are similar to those on the mine except that fewer map units are represented and soil proportions differ. All of the soils, however, can be placed in one of the groups listed in Table 5-3.

An estimate of soil component acreages along the proposed makeup water pipeline corridor is presented in Table 5-4. (Refer to Fig. 4-5 for location of makeup water pipeline.) These acreages are based on corridor widths of 45.7 m (150 ft), 33.5 m (110 ft) and 12.2 m (40 ft). The significance of these widths is as follows:

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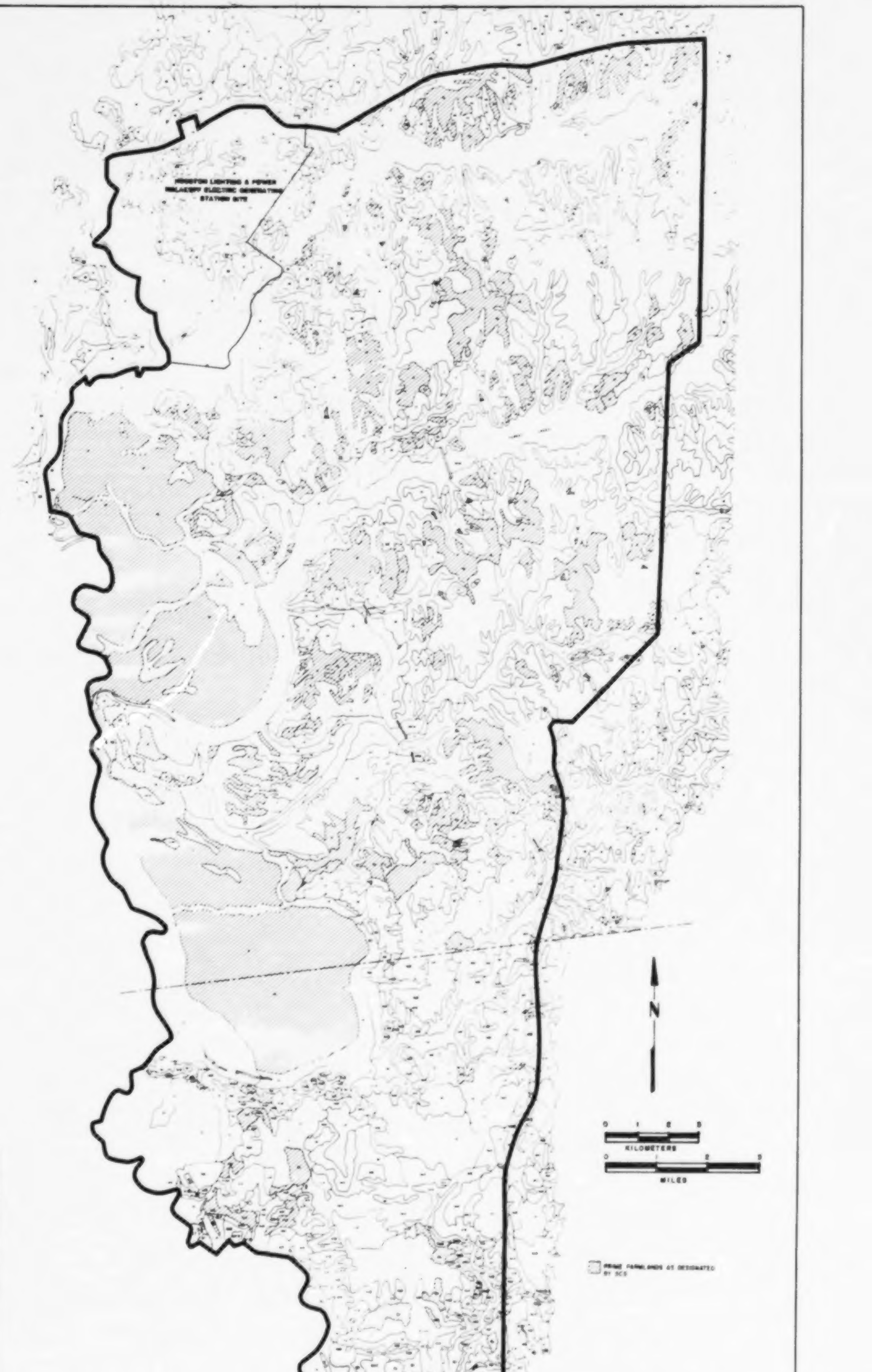
HOUSTON LIGHTING & POWER
MALAKOFF ELECTRIC GENERATING
STATION SITE
N
0 1 2 3
KILOMETERS
0 1 2 3
MILES
▨ PRIME FARMLANDS AS DESIGNATED BY SCS

NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES

SOURCE: NACCO

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-1

SOILS MAP
WITH SCS PRIME
FARMLAND DELINEATED

TABLE 5-1
SOILS OF THE TRINITY MINE PROJECT AREA

Soil Map Unit	Map Unit Symbol		Acres[a]			Percent of Mine Project	Prime Farmland[b]
	Henderson County	Anderson County	Henderson County	Anderson County	Total		
Arenosa fine sand, 1 to 8 percent slopes	-[c]	ArD	-[c]	161	161	0.30	-[d]
Axtell fine sandy loam, 0 to 3 percent slopes	-	AtB	-	834	834	1.54	-
Axtell fine sandy loam, 2 to 5 percent slopes	-	AtC	-	422	422	0.78	-
Axtell fine sandy loam, 5 to 12 percent slopes	-	AtE	-	905	905	1.67	-
Axtell loam, 1 to 5 percent slopes	1	-	7,180	-	7,180	13.26	-
Axtell loam, 5 to 12 percent slopes	2	-	7,830	-	7,830	14.47	-
Axtell-Wrightsville complex, 0 to 1 percent slopes	-	AwA	-	1,137	1,137	2.10	-
Burleson clay	-	Bu	-	283	283	0.52	Yes
Burleson clay, 0 to 1 percent slopes	5	-	254	-	254	0.47	Yes
Crockett loam, 1 to 3 percent slopes	6	-	11	-	11	0.02	-
Darco fine sand, 1 to 8 percent slopes	-	DaD	-	8	8	0.01	-
Deport clay, 0 to 1 percent slopes	9	-	555	-	555	1.02	Yes
Derly-Rader complex	10	-	1,813	-	1,813	3.35	-
Dougherty loamy fine sand, 1 to 5 percent slopes	-	DoC	-	53	53	0.10	-
Dutek loamy fine sand, 1 to 5 percent slopes	12	-	310	-	310	0.57	-
Eufala fine sand, 1 to 8 percent slopes	14	-	1,167	-	1,167	2.15	-
Eustis fine sand, 2 to 8 percent slopes	-	EuD	-	17	17	0.03	0
Ferris clay, 4 to 8 percent slopes	15	-	118	-	118	0.22	-
Ferris clay, 5 to 8 percent slopes	-	FcD2	-	249	249	0.46	-
Freestone fine sandy loam, 1 to 3 percent slopes	16	-	4,183	-	4,183	7.72	Yes
Freestone fine sandy loam, 1 to 5 percent slopes	-	FrC	-	59	59	0.11	Yes
Freestone-Lufkin complex	-	Fs	-	260	260	0.48	-
Fuquay loamy fine sand, 0 to 3 percent slopes	-	FuB	-	7	7	0.01	-
Garner clay	-	Gc	-	1,539	1,539	2.84	-
Gladewater clay, frequently flooded	18	-	2,385	-	2,385	4.41	-
Heiden clay, 3 to 8 percent slopes	-	HeD	-	153	153	0.28	-
Kaufman clay	-	Ka	-	1,159	1,159	2.14	Yes

TABLE 5-1 (Cont'd)

Soil Map Unit	Map Unit Symbol		Acres[a]			Percent of Mine Project	Prime Farmland[b]
	Henderson County	Anderson County	Henderson County	Anderson County	Total		
Kaufman clay, rarely flooded	19	0	5,603	-	5,603	10.34	Yes
Kaufman clay, frequently flooded	20	Kc	734	653	1,387	2.55	-
Kenney loamy fine sand, 1 to 5 percent slopes	-	KeC	-	127	127	0.23	-
Konowa find sandy loam, 2 to 5 percent slopes	-	KsC	-	271	271	0.50	Yes
Konowa soils, 5 to 8 percent slopes, eroded	-	KtD2	-	219	219	0.40	-
Lufkin fine sandy loam, 0 to 1 percent slopes	-	LuA	-	432	432	0.80	-
Nahatche loam, frequently flooded	27	-	3,735	-	3,735	6.89	-
Nahatche and Wehadkee soils	-	Na	-	415	415	0.77	-
Nimrod loamy fine sand, 0 to 3 percent slopes	-	NdB	-	574	574	1.06	-
Normangee clay loam, 1 to 3 percent slopes	-	NoB	-	175	175	0.32	-
Normangee clay loam, 3 to 8 percent slopes	-	NoD	-	530	530	0.98	-
Normangee clay loam, 2 to 5 percent slopes, eroded	28	-	198	-	198	0.36	-
Pits	32	-	263	-	263	0.49	-
Robinsonville fine sandy loam	-	Ro	-	10	10	0.02	-
Silawa fine sandy loam, 1 to 5 percent slopes	33	-	429	-	429	0.79	Yes
Silawa fine sandy loam, 5 to 12 percent slopes	34	-	323	-	323	0.59	-
Stidham loamy fine sand, 1 to 5 percent slopes	-	SmC	-	233	233	0.43	-
Styx loamy fine sand, 1 to 5 percent slopes	35	-	2,410	-	2,410	4.45	-
Thenas fine sandy loam	-	Th	-	13	13	0.02	-
Tonkawa fine sand, 1 to 5 percent slopes	36	-	8	-	8	0.01	-
Trinity clay	-	Tr	-	1,514	1,514	2.79	-
Trinity clay, frequently flooded	41	-	186	-	186	0.34	-
Wilson loam, 0 to 1 percent slopes	42	-	547	-	547	1.01	-
Wilson clay loam, 0 to 3 percent slopes	-	WlB	-	27	27	0.05	-
Wolfpen loamy fine sand, 1 to 5 percent slopes	43	-	8	-	8	0.01	-

TABLE 5-1 (Concluded)

Soil Map Unit	Map Unit Symbol Henderson County	Map Unit Symbol Anderson county	Acres[a] Henderson County	Acres[a] Anderson County	Acres[a] Total	Percent of Mine Project	Prime Farmland[b]
Woodtell loam, 1 to 5 percent slopes	45	-	54	-	54	0.09	-
Woodtell loam, 5 to 15 percent slopes	46	-	232	-	232	0.43	-
Wrightsville clay loam	-	Wr	-	511	511	0.94	-
Water	W	-	368	-	368	0.68	-
Water and borrow pits		W&B.P.	-	61	61	0.11	-
Totals			40,904	13,011	53,915[e]	100.0	12,796 acres (23.71% of project)

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a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

b. Prime farmland as defined by the USDA Soil Conservation Service in Section 657.56 of the Federal Register, Vol. 43, No. 21, Tuesday, Jan. 31, 1978.

c. A dash means the named soil map unit does not occur within the county in question.

d. A dash means not prime farmland.

e. Does not equal to exactly 54,200 acres due to rounding and reproduction techniques. Level of discrepancy less than one percent.

TABLE 5-2
SOILS OF THE POWER STATION SITE

Soil Map Unit	Map Unit Symbol	Acres[a]	Percent of Station Site	Prime Farmland[b]
Axtell loam, 1 to 5 percent slops	1	132	3.88	-[c]
Axtell loam, 5 to 12 percent slopes	2	693	20.38	-
Derly-Rader complex	10	121	3.56	-
Dutek loamy find sand, 1 to 5 percent slopes	11	50	1.47	-
Eufala fine sand, 1 to 8 percent slopes	14	69	2.03	-
Freestone fine sandy loam, 1 to 3 percent slopes	16	174	5.12	Yes
Gladewater clay, frequently flooded	18	1,071	31.50	-
Nahatche loam, frequently flooded	27	100	2.94	-
Silawa fine sandy loam, 1 to 5 percent slopes	33	30	0.88	Yes
Silawa fine sandy loam, 5 to 12 percent slopes	34	23	0.68	-
Styx loamy fine sand, 1 to 5 percent slopes	35	873	25.67	-
Wilson loam, 0 to 1 percent slopes	42	25	0.74	-
Water	W	39	1.15	-
TOTALS		3,400	100.00	204 acres (6.00% of P.P. site)

a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

b. Prime farmland as defined by the USDA Soil Conservation Service in Section 657.56 of the Federal Register, Vol. 43, No. 21, Tuesday, Jan. 31, 1978.

c. A dash means not prime farmland.

TABLE 5-3
GROUPS OF SOILS WITHIN THE MINE BOUNDARY HAVING SIMILAR CHARACTERISTICS

Soil Group	Characteristics of Group	Group Components			Prime Farmland		Major Soil Limitations of Group
		Soil Series	Acres	Percent	Acres	Percent	
A	Upland soils with sandy or silty surfaces and claypan or near-claypan subsoils	Axtell	17,851	33.08	0	0.00	Dense, clayey subsoils, erosive
		Crockett	11	0.02	0	0.00	
		Derly	1,000	1.86	0	0.00	
		Lufkin	536	0.99	0	0.00	
		Wilson	574	1.07	0	0.00	
		Woodtell	286	0.53	0	0.00	
		Wrightsville	968	1.79	0	0.00	
	Subtotal		21,226	39.34	0	0.00	
B	Upland soils with thick sandy surfaces and loamy or clayey subsoils	Arenosa	161	0.30	0	0.00	Thick sandy surfaces, low available water, droughty, erosive
		Darco	8	0.01	0	0.00	
		Dougherty	53	0.10	0	0.00	
		Dutek	310	0.57	0	0.00	
		Eufala	1,167	2.16	0	0.00	
		Eustis	17	0.03	0	0.00	
		Fuquay	7	0.01	0	0.00	
		Kenney	127	0.24	0	0.00	
		Nimrod	574	1.06	0	0.00	
		Stidham	233	0.43	0	0.00	
		Styx	2,410	4.47	0	0.00	
		Tonkowa	8	0.02	0	0.00	
		Wolfpen	8	0.02	0	0.00	
	Subtotal		5,083	9.42	0	0.00	
C	Upland soils with thin sandy surfaces and loamy subsoils	Freestone	4,398	8.15	4,242	7.86	Erosive on steep slopes
		Konowa	490	0.91	271	0.50	
		Rader	813	1.51	0	0.00	
		Silawa	752	1.39	429	0.80	
	Subtotal		6,453	11.96	4,942	9.16	
D	Upland soils with clayey surfaces and clayey subsoils	Burleson	537	0.99	537	0.99	Excessive clay, erosive on steep slopes
		Deport	555	1.03	555	1.03	
		Ferris	367	0.68	0	0.00	
		Garner	1,539	2.85	0	0.00	
		Heiden	153	0.29	0	0.00	
		Normangee	903	1.67	0	0.00	
	Subtotal		4,054	7.51	1,092	2.02	
E	Bottomland soils with sandy or loamy surfaces and sandy or loamy subsoils	Nahatche	3,735	6.92	0	0.00	Flooding
		Wehadkee	415	0.77	0	0.00	
		Robinsonville	10	0.02	0	0.00	
		Thenas	13	0.02	0	0.00	
	Subtotal		4,173	7.73	0	0.00	
F	Bottomland soils that are clayey throughout	Gladewater	2,385	4.42	0	0.00	Flooding, excessive clay
		Kaufman	8,149	15.10	6,762	12.53	
		Trinity	1,700	3.15	0	0.00	
	Subtotal		12,234	22.67	6,762	12.53	
G	Miscellanous land types and water	Pits and	263	0.49	0	0.00	Soil removal (pits) and non-soil (water)
		Water	429	0.80	0	0.00	
	Subtotal		692	1.29	0	0.00	
	TOTAL		53,915	100.00	12,796	23.71	

a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

TABLE 5-4

SOIL ASSOCIATIONS WITHIN THE PIPELINE CORRIDOR

Map Symbol	Association Name and Component Soils	Prime Farmland[a]	Acres[b] Within Mine Boundary[c] 150 ft	110 ft	40 ft	Outside Mine Boundary[c] 150 ft	110 ft	40 ft	Combined[c] 150 ft	110 ft	40 ft
1	Axtell-Freestone		54	40	14	114	83	31	168	123	45
	Axtell (40%)	No									
	Freestone (17%)	Yes									
	Other soils (43%)	-									
2	Darco		-[d]	-	-	33	24	9	33	24	9
	Darco (53%)	No									
	Other soils (47%)										
3	Fuquay-Kirvin-Darco		-	-	-	258	189	69	258	189	69
	Fuquay (26%)	No									
	Kirvin (21%)	No									
	Darco (11%)	No									
	Other soils (42%)										
4	Nahatche		3	2	1	39	29	10	42	31	11
	Nahatche (72%)	No									
	Other soils (28%)										
5	Nahatche-Wehadkee		-	-	-	14	11	3	14	11	3
	Nahatche (70%)	No									
	Wehadkee (20%)	No									
	Other soils (10%)										
6	Pickton-Wolfpen		-	-	-	218	160	58	218	160	58
	Pickton	No									
	Wolfpen	No									
	Other soils										
7	Trawick-Elrose-Bub		-	-	-	67	50	17	67	50	17
	Trawick (40%)	No									
	Elrose (25%)	No									
	Bub (10%)										
	Other soils (25%)										
8	Woodtell-Freestone		2	1	1	18	13	5	20	14	6
	Woodtell (49%)	No									
	Freestone (11%)	Yes									
	Other Soils (40%)										
	TOTALS		59	43	16	761	559	202	820	602	218

a. Prime farmland as defined by the USDA Soil Conservation Service in Section 657.56 of the Federal Register, Vol. 43, No. 21, Tuesday, Jan. 31, 1978.

b. Rounded to nearest whole number. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

c. Columns refer to width of corridor in feet.

d. A dash means the association does not occur within the boundary in question.

1) A 45.7-m (150-ft) wide right-of-way will be cleared for working access during pipeline construction. This involves about 328 ha (820 ac);

2) Thirty-three and a half (33.5) meters (110 ft) of the above right-of-way will revert to the landowner after construction is completed. This involves about 241 ha (602 ac); and

3) The remaining 12.2-m (40-ft) right-of-way will be retained for pipeline maintenance. This involves about 87 ha (218 ac).

Soils along the corridor are similar to those of the proposed mine and power station sites except that the corridor crosses a small area of clayey red soils (Trawick-Elrose-Bub association) that are not found within the mine or power station boundaries.

In summary, soils of the proposed mine, power station and makeup water pipeline corridor range widely in chemical and physical characteristics. Most of the upland soils are highly weathered, acidic and low in natural fertility. Many have undesirable features such as claypans or thick, sandy, droughty surface layers. About 30 percent of the area lies on flood plains, some of which flood frequently. A considerable acreage of the clayey Kaufman soils, however, are protected by levees along the Trinity River, thus are not subject to damaging floods.

5.2.2 Impacts of No Action Alternative

The no action alternative impacts upon soils within the project boundary would most probably be a continuation of the following soil-impacting activities:

1) Increased acreages lost to sand and gravel mining (estimated to total 1,025 ha (2,500 ac) over the 35-year project lifetime);

2) Continued construction of support facilities (roads, site construction, pits, pipelines, etc.) for the oil and gas industry (actual acreage to be affected over the next 35 years could vary significantly dependent upon oil and natural gas price fluctuations);

3) Loss of soils to limited rural and urban residential, and commercial development;

4) Construction of stock tanks and ponds (anticipated to affect extremely small acreage); and

5) Continued agricultural production.

Soil impacts of activities 1) through 4) would result in the continued loss of the soil resource base, plus creating a potential for accelerated erosion during construction phases. Activity 5) should have no adverse impacts if erosion control measures are practiced and a high level of management is maintained. In areas where high levels of management are lacking, soil quality will deteriorate with time.

5.2.3 Impacts of Project Alternatives

5.2.3.1 Impacts of Construction

Proposed Power Station. Of the 1,360 ha (3,400 ac) within the Malakoff EGS boundary, about 164 ha (400 ac) will be impacted for construction of the power station, about 215 ha (525 ac) for the materials handling area and about 58 ha (141 ac) of additional acreage are expected to be disturbed for an estimated total site disturbance of 426 ha (1,066 ac). An additional 308 ha (761 ac) will be impacted along the makeup water pipeline corridor, outside the Malakoff EGS boundary.

Land-clearing prior to construction of these facilities will have short-term, adverse impacts associated with a potential for erosion. This will be reversed as exposed areas are revegetated and normal erosion resumes. Long-term, adverse impacts will exist where soils are more drastically disturbed by grading or excavating to provide building foundations. These impacts will last for the life of the power station.

None of the power station facilities will be constructed on the flood plain of the Trinity River, thus, none of the clayey, bottomland soils will be affected.

Proposed Mine. Ancillary mine facilities will occupy about 116 ha (283 ac). Land-clearing prior to construction will create short-term, adverse impacts due to a potential for accelerated erosion. Long-term, adverse impacts to soils disturbed by grading and excavation for building sites will occur. These soils will require reconstruction upon removal of the facilities.

5.2.3.2 Impacts of Operation

Proposed Power Station. During the life of the power station, about 426 ha (1,066 ac) will be converted from agricultural to industrial use for the life of the power station, including the 215-ha (525-ac) landfill. The landfill will be covered with topsoil and revegetated as it forms to minimize runoff and erosion. The change in soil slope and nature of the underlying substratum will be long term. Impacts of operation should be minimal along the makeup water pipeline right-of-way.

Proposed Mine. The main impacts of mining operations will involve:

1) A potential for accelerated erosion;

2) Subsidence;

3) Changes in the chemical and physical properties of soils and overburden;

4) Changes in SCS prime farmland status (this topic is discussed in Sec. 5.3.3.2 under Proposed Mine); and

5) Potential 10 percent reduction of soil productivity.

Potential for Accelerated Erosion. Short-term, adverse effects of accelerated erosion will occur on sloping areas that have been cleared of vegetation prior to mining and on areas of ungraded overburden prior to reclamation. Affected areas will be prorated over the life of the mine, causing about 400 ha (1,000 ac) to be impacted at a given point in time. Adverse impacts of erosion will be reversed as soon as vegetation is established and normal erosion rates resume.

Subsidence. Studies in Texas (Schneider, 1977) have shown that approximately 75 percent of all expected subsidence will occur during the first year after final grading of mine spoil, and that 80 percent will occur within five years after final grading has been accomplished. Subsequent settling is of negligible magnitude and occurs at a very slow rate. Additional differential subsidence within localized areas may occur for a period of two to six years following final grading. This may cause a micro-relief of highs and lows that, if not modified, may cause localized drainage problems. This impact will primarily affect areas devoted to intensive row crop production.

Chemical and Physical Properties. The impact of changes to the chemical and physical properties on the postmined soils depends on properties of the existing soils, nature of the overburden, and methods of overburden handling. Three alternatives of overburden handling are under consideration by NACCO:

1) A random overburden mix in which the total overburden is used as backfill for adjacent mined-out pits. The backfill is replaced in random fashion, graded to the approximate original contour and prepared for revegetation;

2) A mixture of selected weathered overburden layers in which undesirable material is buried and the regraded surface is composed of selected overburden layers; and

3) Topsoil (A horizon) segregation and replacement over the overburden following final grading to the approximate original contour.

Table 5-5 is a comparison of selected soil characteristics for representative soils from each Soil Group (Table 5-3) which identifies the characteristics of the existing soils and the anticipated soil characteristics using the three different overburden handling techniques: 1) mixed overburden; 2) weathered overburden segregation; and 3) topsoil (A horizon) segregation.

Seven cores from the project area were collected by NACCO and analyzed for select chemical and physical parameters. Of these, five (shown in Table 5-5) can be related to the six soil groups because they are located on or near representative soils of these groups. The anticipated characteristics of postmined soils under the different mining alternatives were determined in Table 5-5 by calculating weighted averages of the soil characteristics listed in the following paragraph. The analyses of only five cores lack statistical validity insofar as representing all overburden characteristics within the mine boundary, however, these cores were collected to satisfy RRC requirements. They represent, at least, the lithology of the area.

TABLE 5-5
SELECTED SOIL PROPERTIES OF PREMINED SOILS COMPARED TO POSTMINED SOILS

Soil Properties	Premining	Mixed Overburden	Weathered Overburden	Topsoiling (A horizon)
Soil Group A (Axtell Series [a]) (Core No. 4) [b]				
Texture	0-6":Loam 6-48":Clay, clay loam, sandy clay	N.A. [c]	N.A.	0-6":Loam 6-48":N.A.
Available Water (% on volume basis) [c]	0-6":11-15 6-48":7-12	12	13	0-6":11-15 6-48":12
Cation Exchange Capacity (Me/100 g)	0-6":3-5 6-48":16-20	N.A.	N.A.	0-6":3-5 6-48":N.A.
pH	0-6":5.1-6.5 6-20":4.5-5.5 20-48":5.1-7.1	6.1	7.0	0-6":5.1-6.5 6-48":6.1
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	8.3	0.9	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	18.2	27.8	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-6":2 6-48":3	-9.9	-26.9	0-6":2 6-48":-9.9
Soil Group B (Styx Series [a]) (Core No. MC81-10CC) [b]				
Texture	0-22":Loamy fine sand 22-48":Sandy clay loam	Sandy clay loam	Sandy clay loam	0-10":Loamy fine sand 10-48":Sandy clay loam
Available Water (% on volume basis)	0-22":5-11 22-48":12-17	15	18	0-10":5-11 10-48":15
Cation Exchange Capacity (Me/100g)	0-22":3-5 22-48":7-10	8.3	13.5	0-10":3-5 10-48":8.3
pH	0-22":6.1-6.5 22-48":4.5-5.0	5.2	5.7	0-10":6.1-6.5 10-48":5.2
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	3.3	0.3	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	-0.4	-0.5	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-22":0.5 22-48":2.5	3.7	0.8	0-10":0.5 10-48":3.7
Soil Group C (Freestone Series [a]) (Core No. 1) [b]				
Texture	0-14":Fine sandy loam 14-34":Sandy clay loam, loam, clay 34-48":Clay, clay loam	N.A.	N.A.	0-10":Fine sandy loam 10-48":N.A.
Available Water (% on volume basis)	0-14":11-15 14-34":12-17 34-48":12-18	10	10	0-10":11-15 10-48":10
Cation Exchange Capacity (Me/100 g)	0-14":4-6 14-34":6-9 34-48":10-14	N.A.	N.A.	0-10":4-6 10-48":N.A.
pH	0-14":5.1-7.3 14-48":4.5-6.5	6.6	6.8	0-10":5.1-7.3 10-48":6.6
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	2.7	3.9	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	14.3	12.6	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-14":2.0 14-34":2.0 34-48":0.0	-11.6	-8.7	0-10":2.0 10-48":-11.6

TABLE 5-5 (Concluded)

Soil Properties	Premining	Mixed Overburden	Weathered Overburden	Topsoiling (A horizon)
Soil Group D (Garner Series [a]) (Core No. 4) [b]				
Texture	0-48":Clay	N.A.	N.A.	0-10":Clay 10-48":N.A.
Available Water (% on volume basis)	0-48":12-18	12	13	0-10":12-18 10-48":12
Cation Exchange Capacity (Me/100 g)	0-48":45	N.A.	N.A.	0-10":45 10-48":N.A.
pH	0-48":5.6-8.4	6.1	7.0	0-10":5.6-8.4 10-48":6.1
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	8.3	0.9	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	18.2	27.8	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-48":2.0	-9.9	-26.9	0-10":2.0 10-48":-9.9
Soil Group E (Nahatche Series [a]) (Core No. 5) [b]				
Texture	0-13":Loam 13-48":Loam, clay loam, silty clay loam	N.A.	N.A.	0-10":Loam 10-48":N.A.
Available Water (% on volume basis)	0-13":10-15 13-48":10-15	14	27	0-10":10-15 10-48":14
Cation Exchange Capacity (Me/100 g)	0-13":12-15 13-48":17-20	N.A.	N.A.	0-10":12-15 10-48":N.A.
pH	0-13":5.1-7.8 13-48":5.1-7.8	5.8	5.7	0-10":5.1-7.8 10-48":5.8
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	3.0	3.7	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	20.3	16.8	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-13":1.5 13-48":1.5	-17.3	-13.1	0-10":1.5 10-48":-17.3
Soil Group F (Kaufman Series [a]) (Core No. MC 81-11CC) [b]				
Texture	0-48":Clay	Loam	Sandy clay loam	0-10":Clay 10-48":Loam
Available Water (% on volume basis)	0-48":15-18	16	13	0-10":15-18 10-48":16
Cation Exchange Capacity (Me/100 g)	0-48":45	17.7	15.7	0-10":45 10-48":17.7
pH	0-48":6.1-8.4	7.8	7.6	0-10":6.1-8.4 10-48":7.8
Maximum Potential Acidity (Tons $CaCO_3$/1,000 Tons)	N.A.	2.4	0.3	N.A.
Neutralization Potential (Tons $CaCO_3$/1,000 Tons)	N.A.	10.7	10.9	N.A.
Net Potential Acidity (Tons $CaCO_3$/1,000 Tons)	0-48":0.0	-8.3	-10.6	0-10":0.0 10-48":-8.3

a. Soil series selected as representative of group.

b. Indicates core data used to determined characteristics of overburden.

c. N.A. means data not available.

The soil characteristics selected and their definitions follow:

Soil Texture	Refers to the relative proportion of mineral particles of various sizes, i.e., sand, silt and clay, within a given soil.
pH	Measure of the acidity in the soil. The most favorable pH range for most growing crops is 5.8 to 7.2. Soils with a pH lower than 4.5 or higher than 8.5 are poor soils for most crops. Soils with a pH lower than 4.5 or higher than 8.5 are poor soils for growing pastureland grasses.
Maximum Potential Acidity	The highest potential for acidity within the soil material. This includes all acid-producing substances, including pyritic sulfur. Figures are expressed as tons of $CaCO_3$ equivalent per 1,000 tons (an acre turrow slice, or 2,000,000 pounds) of soil.
Neutralization Potential	The highest potential for neutralizing the potential acidity, through the neutralizing ability of basic cations such as calcium, magnesium, potassium and sodium. Figures are expressed as tons of $CaCO_3$ equivalent per 1,000 tons (an acre furrow slice, or 2,000,000 pounds) of soil.
Net Potential Acidity	The amount of acidity that must be neutralized to bring an acid soil to a predetermined pH value. For example, 1.3 tons per 1,000 tons of soil is equivalent to 1.3 tons of lime to an acre furrow slice (2,000,000 pounds) of soil. The higher the net potential acidity the more lime will be required to neutralize the soil.
Available Water	The amount of water held by soils that is available for plant use; based on volume of water available

	for plant use per unit volume of soil, expressed as percent.
Cation Exchange Capacity (CEC)	The amount of positively charged elements, such as hydrogen, magnesium, calcium, potassium and sodium that can be adsorbed by the soil.

The data indicate that the overburden is generally not acid-forming or toxic, and does not contain excessive salts. The samples that exhibit an acid-forming potential, generally fall below the potentially toxic criteria (Smith et al., 1974) of five tons net potential acidity per thousand tons of overburden material. The sample intervals that do exhibit an acid-forming potential in excess of 5 tons/1,000 tons of material tend to be positioned immediately above or below one of the recoverable lignite seams. This positional trend easily allows for deep burial should it become necessary.

Although organic matter was not determined for the cores analyzed, and texture was determined for only two cores, studies on overbuden soils (Fresquez and Lindeman, 1982) indicate that major limitations of random overburden mix (Alternative One) will be low organic matter in the surface layer, surface crusting, poor soil structure and low microbial numbers. These adverse features will be corrected during phase two soil reconstruction activities as vegetation reestablishes organic matter. Table 5-5 shows that, by assuming a random overburden mix, the pH is within acceptable limits and is less acid than surface layers of the representative Axtell series in Soil Group A. This table also shows that the net potential acidity is less in a total mix than that of the Axtell soils. However, a uniformly random mix is highly unlikely, thus, localized "hot spots" of acid-bearing materials will likely occur where unmixed acidic layers are placed on the surface. The impact of localized hot spots will be short term, as RRC regulations require either lime treatment or 48 in. of suitable soil cover on these areas.

The major impact on Group B soils caused by the use of a random overburden mix will be replacement of the thick loamy fine sand surface with sandy clay loam textures. This will create a potential for crusting and related adverse effects discussed in the preceding paragraph. The data show that the sandy clay loam surface will have a higher available water capacity than presently exists, thus, surface layers will probably be less droughty. Lime requirements will be higher in the overburden than in the Styx soils but within economically feasible limits. Due to incomplete mixing, localized hot spots may create short-term, adverse effects that, under RRC regulations will be corrected either by liming or covering with 48 in. of suitable soil cover.

Core data on Soil Group C does not include textural classes, thus, a valid comparison of mixed overburden and existing soil textures cannot be made. Other core data in Table 5-5, plus the lithology of the region, suggest a sandy clay loam surface which will have the short-term, adverse impacts of crusting, low organic matter, poor structure and low microbial count. Available water appears to be slightly higher in the existing representative Freestone soils than in the mixed overburden, however, none of the values suggest highly doughty conditions. Overburden pH values fall roughly between values given for the Freestone series, at least in the surface. The data show that Freestone soils need small amounts of lime, within economically feasible limits and no initial lime requirements for the overburden. Due to incomplete mixing, localized hot spots may occur in the surface of the mixed overburden. As discussed earlier, these are short-term impacts, correctable either by liming or covering with suitable soil material.

Textural data are not available for core comparison to Soil Group D, represented by the Garner series. Other data in Table 5-5 suggest sandy clay loam textures compared to clay in the existing soil. Until vegetation is reestablished under phase 2 soil reconstruction activities, the short-term, adverse impacts of low organic matter and related problems discussed above will occur. Available water is within the lower range given for the Garner series, as is the pH. The net potential acidity indicates moderate lime requirements for the Garner series as opposed to no initial liming requirements for the random overburden mix. Localized areas of acidic materials due to incomplete mixing may occur in the overburden mix. This is a short-term impact, correctable by additions of lime or covering with suitable soil material.

Textural data are not available for core data on Group E soils, represented by the Nahatche series but a mixture of the Wilcox formation will probably result in a sandy clay loam. This will probably create the short-term, adverse conditions of low organic matter and related features discussed earlier. Available water and pH values of the mixed overburden are within ranges given for the Nahatche series. The net potential acidity indicates that Nahatche soils require moderate amounts of lime whereas no initial lime application is needed on the mixed overburden. Localized areas of acidic soils may occur on the overburden. This is a short-term impact, correctable, as discussed previously, by additions of lime or by covering with suitable soil material.

Group F consists of deep, calcareous clayey alluvial soils having a high shrink-swell potential. A total overburden mix contains less clayey materials, thus, will have a loamy profile. Cracking, due to high shrink-swell potential, will be less severe in the overburden mix than in the premined soil. However, due to low organic matter and poor structure, crusting and related problems will probably occur in the mixed overburden. As discussed previously, these are short-term impacts that will be corrected during phase two soil reconstruction activities by additions of organic matter. Available water (see exceptions under general conditions, below) and pH are within acceptable ranges for both premined soils and the mixed overburden. The same is true for cation exchange capacity, although due to the nature and content of clays, the premined soil has CEC values higher than common to the area. Net potential acidity values indicate that neither material needs lime, although the overburden may have local acid spots due to incomplete mixing. As discussed earlier, this is a short-term impact because RRC regulations require correction of such areas by liming or covering with 48 in. of suitable soil material.

Core data indicate considerable sand and gravel within the substratum of the Kaufman series at depths of approximately 3.5 to 8.6 m (11.6 to 28.4 ft). NACCO plans either to mine these mateirals or to bury them at depths below the major root zone. Under these conditions there would be no adverse impacts. The appearance of excessive amounts of these materials within the root zone would create long-term, irreversible impacts in the form of reduced available water for plant consumption.

Alternative Two, the use of weathered overburden, is comprised of a mixture of the upper part (oxidized zone) of the overburden. Table 5-5 shows the probable characteristics of soils in such materials. In Soil Group A, the core data indicate that soils derived from the weathered overburden are similar to those derived from a mixture of the total overburden (texture and cation exchange capacity excluded because of no data). The main difference lies in a lower maximum potential acidity and higher neutralization potential in the weathered overburden, resulting in a much lower value for net potential acidity. Available water of surface layers is within the range of the representative Axtell soils in Group A but is higher than that of the clayey subsoil of Axtell. No initial liming is required in the weathered overburden. There is less chance of localized hot spots than in a randomly mixed overburden soil. As with a totally mixed overburden, short-term, adverse effects will exist due to crusting, low organic matter and low microbial count.

The weathered overburden in Soil Group B has properties similar to that of the mixed overburden except that it has a higher cation exchange capacity and lower net potential acidity. Compared to the representative Styx series, the weathered overburden contains more clay in the surface. This results in a considerably higher water holding capacity and cation exchange capacity. There is a potential for short-term impacts of low organic matter and related problems, as discussed earlier, in the weathered overburden. Net potential acidity shows that less lime is required for the weathered overburden than the premined soil but liming is economically feasible in both cases.

Within Group C, the weathered overburden has properties quite similar to those of the mixed overburden, thus, impacts will be similar to those discussed for the mixed overburden (texture and cation exchange capacity possibly excluded because data are not available). Textures cannot be compared to those of the representative Freestone soils of this Group. Surface pH is within the range of the Freestone series and subsoil pH is slightly higher. Net potential acidity indicates moderate liming needs for the Freestone soils and no initial liming is required for the weathered overburden. The probability of localized highly acidic areas in the weathered overburden is slight.

Data are not available for texture and cation exchange capacity for the weathered overburden underlying the soils of Group D, Table 5-5. Available water is similar to that of the mixed overburden and is within the range shown for the premined soil (Garner series). pH is higher than that of the mixed overburden and within the range shown for Garner soils. Net potential acidity is considerably lower than that of either the mixed overburden or the Garner series. Chances are slight that localized acidic areas will occur at the surface. Surface layers in the weathered overburden will probably experience short-term, adverse impacts of crusting, low organic matter and low microbial count. As discussed earlier, these will be corrected when vegetation is reestablished.

Weathered overburden underlying Group E soils, Table 5-5, shows a higher water holding capacity than either the mixed overburden or the representative Nahatche soils. The value shown may be aberrantly high since it exceeds by a considerable amount any of the other values shown in Table 5-5. The pH is similar to that of the mixed overburden and is within the range of values given for the Nahatche soils. As with the mixed overburden, the net potential acidity indicates no initial liming requirements, compared to moderate requirements for the Nahatche series. The probability of localized acidic areas is slight. Textural class and cation exchange capacity values cannot be predicted with certainty because laboratory analyses were not determined. Short-term, adverse impacts will probably result from low organic matter, low microbial count and crusting.

The weathered overburden of the core underlying Group F soils is similar to that of the mixed overburden except that texture averages sandy clay loam instead of loam. This compares to clayey textures in the representative premined soil (Kaufman). Available water (see possible exceptions below) and pH are also within ranges shown for the Kaufman soil. Cation exchange capacity is within acceptable ranges although considerably less than that of the clayey Kaufman soil. The net potential acidity values indicate that neither the Kaufman nor the weathered overburden requires additions of lime. The probability of localized acidic spots is slight. Cracking, due to high content of shrink-swell clays, is less likely on the weathered overburden. Short-term, adverse impacts due to crusting, low organic matter and low microbial count are likely to occur on the weathered overburden.

The conditions under which sand and gravel are present within the substrum in parts of these soils, and their adverse impacts are discussed under Soil Group F, Alternative One. Should these conditions exist under Alternative Two, the impacts would be similar.

Alternative Three consists of topsoiling a mixed overburden with the A horizon of existing soils. A depth of 10 in. of topsoil is used in Table 5-5 to illustrate probable characteristics for all soils except for the Axtell series. The surface layer (0 to 10 in.) of the reconstructed soil will have characteristics of the representative soil series shown in Table 5-5. The subsoil will have the characteristics of the mixed overburden, shown in the same table.

Within Soil Group A, the surface layer will be loam assuming only the A horizon is used. However, the data indicate the A horizon of Axtell is only six inches thick and is underlain by a dense claypan. Thus, the topsoil may only be six instead of ten inches thick. The claypan should be avoided for topsoil material. Data are not available to determine texture of the underlying surface layer. Available water will be comparable to both mixed and weathered overburden soils. The lower range of pH in the surface will be more acid than either of the overburden soils and the subsoil will have a pH equivalent to that of the mixed overburden. Liming will be required for the surface layer but the occurrence of localized highly acidic areas is unlikely. There should be no adverse impacts due to crusting and, if stockpiled for short periods of time, no impacts due to lower organic matter content or lower microbial count than exists in the surface of the premined soil. Fresquez and Lindeman (1982) have found, however, that prolonged stockpiling has short-term, adverse impacts of lowering the microbial count. Those writers postulate the cause is due to an unfavorable environment for microbes and conclude that plant establishment might be slowed during reclamation where material has been stored for long periods of time prior to replacement on the surface.

Within Soil Group B, surface textures following topsoiling will be loamy fine sand similar to that of the representative Styx soils. Water holding capacity is low in the surface compared to either of the overburden alternatives but the layer is thinner than in premined soils, which will probably create less droughty conditions than exist at present. The soil will need liming but this condition also exists in the other alternatives as well as in the premined soils. All liming rates are economically feasible. The probability of crusting, lowered organic content and poor structure is slight. Under prolonged stockpiling, the microbial population could be adversely effected for a short period of time. The probability of localized highly acidic areas is slight.

In Soil Group C, the surface 10 inches will be fine sandy loam as in the existing representative Freestone soils. Subsoil of the underlying material is unknown although the lithology of the area suggests sandy clay loam, a texture comparable to that of Freestone. Liming requirements will be comparable to those of Freestone. Available water will be comparable to that of Freestone, at least in the surface layer. According to data in Table 5-5, available water could be slightly less in the subsoil. Surface pH will be comparable to the premined soil as well as that of the mixed and weathered overburden alternatives. Subsoil pH will be higher than that of the premined soils and comparable to that of the overburden alternatives. Net potential acidity in the surface will be comparable to that of the premined soil and greater than that of the overburden alternatives. Moderate amounts of lime will be required. Surface crusting should be negligible and there should be little impacts on structure, organic matter and microbial, population unless the soil is subjected to prolonged stockpiling.

Under topsoiling, Soil Group D surface textures will be clay as in the existing representative Garner series. Subsurface textures are unknown but according to lithology of the area, will most likely be sandy clay loam. Available water will be comparable to that of the premined soil as well as the overburden alternatives. Net potential acidity values indicate that surface layers will require moderate amounts of lime. The clayey surface layer offers the same long-term, adverse impacts of tillage difficulties described for the Garner series. The possibility of localized highly acidic areas is slight. Stockpiling and additional handling of the clayey surface layer may offer adverse impacts on the structure of the clay, as well as the microbial count.

Soil Group E will have a loam surface and, although data are not available, lithology of the area suggests a sandy clay loam subsoil. Available water will be comparable to that of the existing soil as well as that of both overburden alternatives. The same is true for pH. Surface liming requirements are moderate, and are comparable to that of the existing soils. In comparison, no initial liming is required for the overburden alternatives. Compared to the overburden alternatives, there should be no problems with surface crusting, structure or excessively low organic matter content. Prolonged stockpiling may lower the microbial count and have short-term, adverse impacts on revegetation. There should be no problems with localized hot spots.

Under topsoiling, the soils of Group F will have a clay surface, with a high shrink-swell potential, and a loam subsoil. The surface will crack during dry periods and will have poor tillage characteristics due to the plastic nature of the clay in Kaufman soils which represent the groups. According to data in Table 5-5, water holding capacity will be very high in the surface and less in the subsoil, although adequate during most years for most crops (see discussion below on possible effects of gravel in the subsoil). The pH will be comparable to that of the premined soils as well as that of the overburden alternatives. It is unlikely that localized highly acidic areas will occur. Stockpiling of surface layers may create short-term, adverse impacts on surface structure and microbial count. The subsoil, which consists of mixed overburden, may contain excessive amounts of gravel and sand, as discussed in Soil Group F, Alternative One. Under these conditions, impacts would be similar to those discussed in that section.

In summary, short-term, adverse impacts of crusting, lack of structure and lower organic content and mircrobial count are more likely to occur in all soil groups under the mixed overburden and weathered overburden handling techniques (Alternatives One and Two). These impacts will be corrected during phase two reconstruction activities as vegetation reestablishes organic matter. NACCO has entered a cooperative agreement with the SCS for handling postmined soils. The SCS program requires acceptable agronomic practices for successful revegetation.

The probability for localized highly acidic areas is greatest in Alternative One, second in Alternative Two and least in Alternative Three. This adverse impact is short term in that RRC regulations require liming or burial under 48 in. of suitable material to correct.

Available water amounts are adequate using either of the three alternatives with a possible exception in Soil Group F should excess gravel and sand appear in the profile. Such an occurrence would create irreversible adverse impacts.

Liming requirements are least in Alternatives One and Two except in Soil Group F, where data indicate that no lime is required under any of the alternatives or in the existing soils. As discussed earlier, localized highly acidic areas could occur in Alternatives One and Two, requiring lime or other suitable treatment.

Textural and cation exchange capacity data are not available for all cores. The available data and lithology of the area suggest textures approximating sandy clay loam for Alternatives One and Two. This texture would be less droughty than the thick loamy fine surfaces of soils in Group B and would crack less and be more easily tilled than the clayey surfaces of soils in Groups D and F.

In certain soil groups, the use of either of the alternatives could provide beneficial impacts. The existing adverse impacts of claypans in soils of Group A will be improved. Droughty characteristics of the thick sandy surfaces of soils within Group B will be lessened by any of the alternatives. The adverse impacts of existing clayey surfaces in soils of Groups D and F will be alleviated except in Alternative Three (topsoiling) where the same materials would appear on surfaces of reconstructed soils.

Productivity figures, except as stated below, are unavailable for representative overburden materials. A possible comparison is available on an existing mine about 40 km (25 mi) southwest of the Trinity Mine. There, where the premined soils were Axtell (representative of Group A), the Soil Conservation Service has described a randomly mixed overburden soil with the proposed name Bigbrown. SCS interpretations for Bigbrown (TX 087, HEB, LCB, 7-79) and Axtell (TX 038, Rev. GLL, CLG, 3-81) show, on 1 to 3 percent slopes, comparable yields for the two soils. This comparison should be valid for soils of Group A in the Trinity Mine but does not infer that other Soil Groups would present similar results.

In addition to overburden analyses, the Texas Coal Mining Regulations may require greenhouse tests and field test trials to demonstrate that overburden materials may be substituted for topsoil removal and replacement. A greenhouse study was conducted by Texas A&M University using overburden materials to test coastal bermudagrass under different fertility rates. The results were summarized by Espey, Huston & Associates, Inc. (EH&A, 1979). The conclusions, based on limited data from three cores, were that tame pasture on mixed overburden, when properly managed, should produce a more rigorous and denser ground cover than occurred on the site prior to mining. Additional greenhouse studies may be required.

NACCO established a soil reconstruction field experiment in 1982, to be conducted for several years. The experiment is designed to evaluate the feasibility of using: 1) mixed upland overburden; and 2) mixed alluvial overburden as a topsoil (A horizon) and subsoil (B and C horizons) substitute material. Data from this study will be published as they become available.

Potential 10 Percent Reduction of Soil Productivity. Texas Coal Mining Regulations set more rigorus performance standards for RRC prime farmland than for SCS prime farmland. SCS prime farmland is land which has not been historically used for the production of crops (typically excluding hay) but meets other RRC prime farmland criteria. The RRC prime farmland vegetation performance standard for success requires 100 percent (or its equivalent) attainment of an approved target yield, compared to 90 percent attainment of an approved target yield for SCS prime farmland. The mining of prime farmland soils will result in a long-term, adverse impact since prime farmland characteristics will be lost. The resulting soil will still be capable of supporting growth but may not have the same level of productivity as the existing soils.

5.3 PRIME FARMLAND

5.3.1 Existing Environment

Figure 5-1 shows the location of prime farmland soils on the proposed sites of the Trinity Mine and the Malakoff EGS, according to criteria established by the USDA Soil Conservation Service in Section 657.56 of the Federal Register, Vol. 43, No. 21, Tuesday, January 31, 1978. This is commonly referred to as SCS prime farmland. It does not consider criteria contained in Section 138(b) of Coal Mining Regulations published

January 1, 1981, by the Railroad Commission of Texas (RRC). In essence, these criteria exclude land from prime farmland if the applicant can demonstrate that it has not been historically used as cropland. Land historically used as cropland is defined, in context, as lands that have been used for cropland for any five years or more out of the 10 years immediately preceding acquisition for the lease or option to conduct surface coal mining and reclamation operations, as defined by Section 008 of the RRC regulations.

Table 5-1 presents a summary of SCS-designated prime farmland soils showing that approximately 5,188 ha (12,796 ac), or about 23.61 percent of the area within the proposed mine boundary, is defined as prime farmland soils. About 2,870 ha (7,174 ac) of the SCS prime farmland is controlled by NACCO. Of this, NACCO determined that approximately 80 percent (2,343 ha (5,715 ac)) has not been historically cropped, thus fails to qualify as prime farmland under RRC and OSM criteria. Table 5-2 shows that about 82 ha (204 ac), or about six percent of the proposed power station site, is prime farmland soils. Table 5-3 shows a marked relationship between prime farmland soils and groups of soils having similar properties. None of the soils in Groups A, B, E or G qualify as prime farmland. This is due primarily to properties entailing claypans, thick sandy surfaces and flooding. Groups C, D and F contain prime farmland, although not every soil qualifies, and none of the soils having slopes greater than five percent qualify. Only about 12 ha (30 ac) of prime farmland soils will be subject to impacts during construction of the makeup water pipeline. Of this, about 8.8 ha (22 ac) will revert to the landowner upon completion of construction work, leaving about 3.2 ha (8 ac) along a right-of-way to be maintained for the life of the pipeline. No prime farmland soils occur within the transmission line corridor.

Figure 5-1 shows that the largest continuous areas of prime farmland lie on the west side of the proposed project area. This is primarily Kaufman clay, found on the former flood plains of the Trinity River, that has been cleared, drained and protected by levees from flooding. This soil map unit represents more than half of the prime farmland within the project boundary. The remaining prime farmland occurs on upland slopes of less than five percent and is fairly evenly distributed in scattered tracts throughout the area.

Table 5-1 presents two map unit complexes which contain both prime and non-prime soils should they occur alone within a map unit. These are the Derly-Rader complex (in which Derly is prime and Rader is non-prime) and the Freestone-Lufkin complex (in which Freestone is prime and Lufkin is non-prime). Both units occupy a landscape of complexly associated mounds and intermounds. The soil member of the complex that determines the crop management of the unit determines the farmland class of that unit. In the case in point, Rader and Lufkin are wet soils (non-prime), and thus control the periods in which the respective units can be cultivated. The entire map unit, as a land area, is, thus, considered non-prime by SCS criteria, even though it contains soils that qualify as prime farmland where they occur alone (Marks, 1982). In the case of the Axtell-Wrightsville complex and the Nahatche and Wehadkee map units, all the soil components are non-prime as individuals, thus, the map units are non-prime.

5.3.2 Impacts of No Action Alternative

The impacts of no action alternatives on prime farmland within the project are similar to those described for soils in Sec. 5.2.2. Much of the increased acreage lost to sand and gravel mining would impact prime farmland because this action is largely confined to alluvial soils of the Trinity River, which are prime farmland soils since the soils are protected from flooding.

5.3.3 Impacts of Project Alternatives

5.3.3.1 Impacts of Construction

Proposed Power Station. About 35 ha (86 ac) of prime farmland will be occupied by power station facilities. These areas will be adversely affected by short-term accelerated erosion following clearing for construction. Some areas may be adversely affected by grading and excavation during preparation of building foundations. Conversion of prime farmland from agricultural to industrial use will result in a long-term but minor (due to small acreages) adverse impact. This loss of prime farmland will be irretrievable. Only about 12 ha (30 ac) will be cleared and subject to short-term erosion during construction of the makeup water pipeline. Drastic disturbance will involve only the pipeline trench, thus few, if any, acres of prime farmland soils will be affected by this action. None of the prime farmland soils in the Trinity River bottom will be affected by the power station construction.

Proposed Mine. Approximately 20 ha (49 ac) of prime farmland soils will be occupied by ancillary mine facilities. Adverse impacts will be similar to that affected by construction on the power station site.

5.3.3.2 Impacts of Operation

Proposed Power Station. Of the 426 ha (1,066 ac) converted from agricultural to industrial use (Sec. 5.2.3.2) for the life of the power station, about 35 ha (86 ac) will be prime farmland. These areas are the same as those impacted during construction. Only about 3 ha (8 ac) of prime farmland lie in the makeup water pipeline right-of-way. This conversion represents a long-term, adverse impact and an irretrievable loss of the resource.

Proposed Mine. A total of about 3,829 ha (9,338 ac) of prime farmland, as defined by the SCS, will be disturbed during the life of the mine. The potential for accelerated erosion between time of clearing and revegetation will be similar to the general conditions described under Proposed Mine in Sec. 5.2.3.2. The same is true for subsidence. The physical and chemical properties of the reconstructed prime farmland soils will depend on which alternative (see Sec. 5.2.3.2) is selected for overburden handling, but under any of the three alternatives, the morphology and composition of the reconstructed soils will experience long-term, irreversible changes from that of the existing prime farmland soils. Texas Coal Mining Regulations set more rigorous performance standards for RRC prime farmland than for SCS prime farmland. SCS prime farmland is land which has not been historically used for the production of crops (typically excluding hay) but meets other RRC prime farmland criteria. The RRC prime farmland vegetation performance standard for success requires 100 percent (or its equivalent) attainment of an approved target yield, compared to 90 percent attainment of an approved target yield for SCS prime farmland. The mining of prime farmland soils will result in a long-term, adverse impact since prime farmland soil characteristics will be lost. The resulting soil will still be capable of supporting growth but may not have the same level of productivity as the existing soils.

5.3.3.3 Combined

A total of about 59 ha (143 ac) will be subjected to accelerated erosion during construction phases of the proposed power station and mine. This involves primarily construction of power station, pipeline and mine ancillary facilities. This adverse impact will be short term. Conversion of this acreage from agricultural use to industrial use will have long-term, but minor (small acreage), adverse impacts on prime farmland resources. Creation of a 215-ha (525-ac) soild waste disposal area will result in long-term, irreversible, adverse impacts. During mining operations, about 400 ha (1,000 ac) will be bare of vegetation at any given point in time. Potential accelerated erosion on these areas will create short-term, adverse impacts. Changes in soil morphology may have long-term, irreversible, adverse impacts on significant acreages.

5.3.3.4 Cumulative

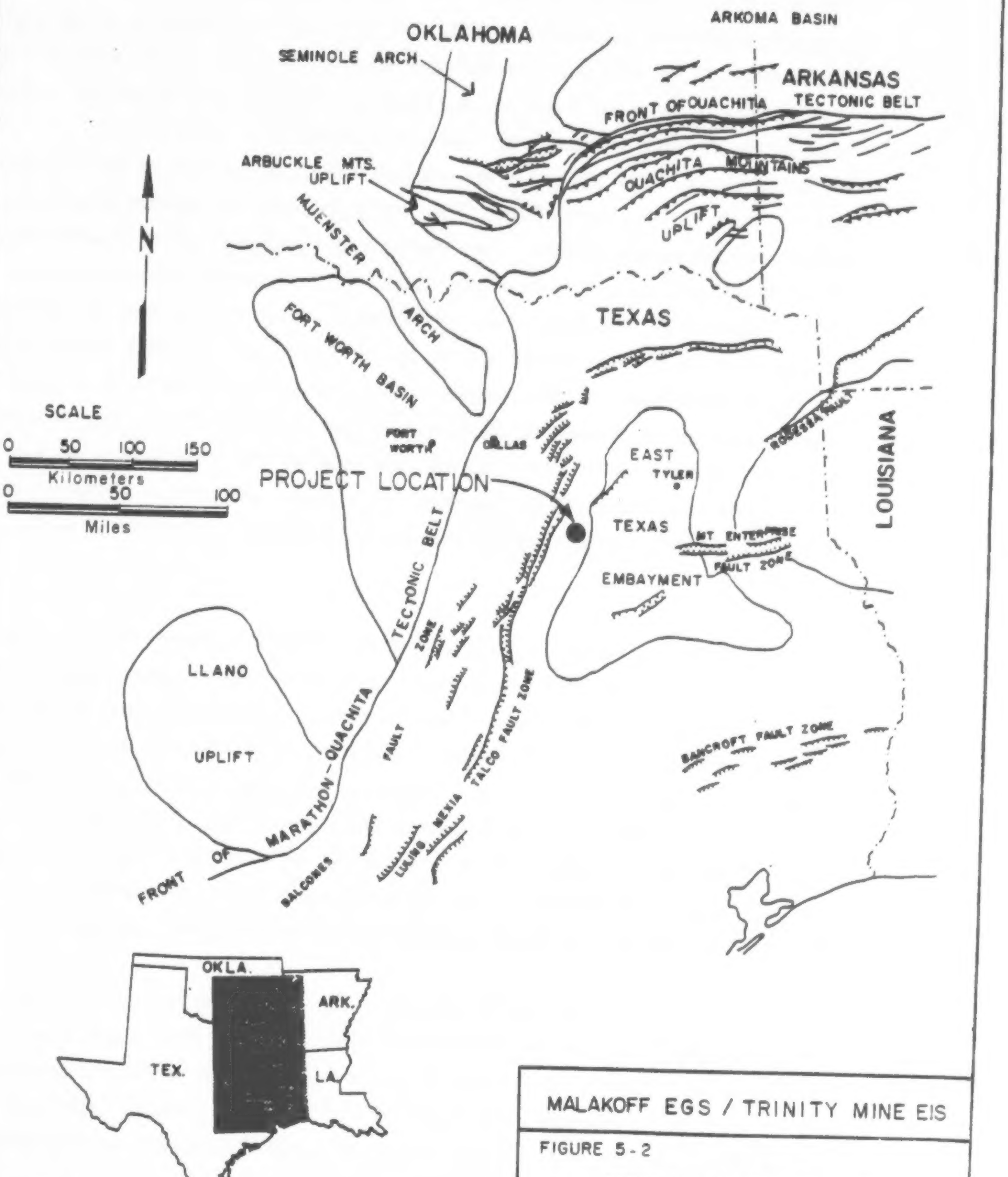
In discussing the cumulative impacts on prime farmland soils from development of several lignite mining operations, it should be noted that impacts to prime farmland are project specific and depend on a number of independent variables, the least of which is the number of acres of prime farmland soils which will actually be affected. Secondly, the mining and reclamation procedures to be established at individual mines will vary. Site specific geologic features, including chemical and physical properties of the overburden, also vary greatly. Because of these variables, no defensible assessment of cumulative impacts is possible.

5.4 GEOLOGY

5.4.1 Existing Environment

The project area is located on the western flank of the East Texas Embayment, a structural trough marked by a zone of thick sediment accumulation. The axis of the basin is west of and roughly parallel to the Sabine Uplift, and extends in a north-south direction east of the project area (Fig. 5-2). These two structural features were the dominating influence of the geology of the east Texas region.

Deposition and subsidence in the East Texas Embayment during the Tertiary Age resulted in localized flexures and major fault zones. There are three major fault zones in the region, as indicated by Fig. 5-2: the Elkhart-Jarvis Mount Enterprise Fault System located in the south-central portion of the basin; the Rodessa Fault System located along the northern flank of the Sabine Uplift; and the Luling-Mexia-Talco Fault System occurring along the western edge of the East Texas Embayment. The most relevant of the fault systems to the project area is the Luling-Mexia-Talco system which consists of a parallel series of normal faults. These faults display both up-to-the-coast and down-to-the-coast displacement resulting in graben structures formed where narrow blocks are dropped between two normal faults. Maximum displacement along the fault zone is about 305 m (1,000 ft). The surface extent of the fault system lies essentially within the


OKLAHOMA
ARKOMA BASIN
SEMINOLE ARCH
ARKANSAS
FRONT OF OUACHITA TECTONIC BELT
ARBUCKLE MTS. UPLIFT
OUACHITA MOUNTAINS
UPLIFT
MUENSTER ARCH
FORT WORTH BASIN
TEXAS
N
SCALE
0 50 100 150
Kilometers
0 50 100
Miles
FORT WORTH
DALLAS
PROJECT LOCATION
EAST TEXAS EMBAYMENT
TYLER
MT ENTERPRISE FAULT ZONE
ROSESSA FAULT
LOUISIANA
LLANO UPLIFT
FRONT OF MARATHON-OUACHITA TECTONIC BELT
BALCONES FAULT ZONE
LULING MEXIA TALCO FAULT ZONE
BANCROFT FAULT ZONE
OKLA.
ARK.
TEX.
LA.

SOURCES:

A.A.P.G. GEOLOGICAL HIGHWAY MAPS (TECTONIC MAPS) OF TEXAS (1973), MID-CONTINENT REGION (1966), AND SOUTHEASTERN REGION (1975)

MALAKOFF EGS / TRINITY MINE EIS

FIGURE 5-2

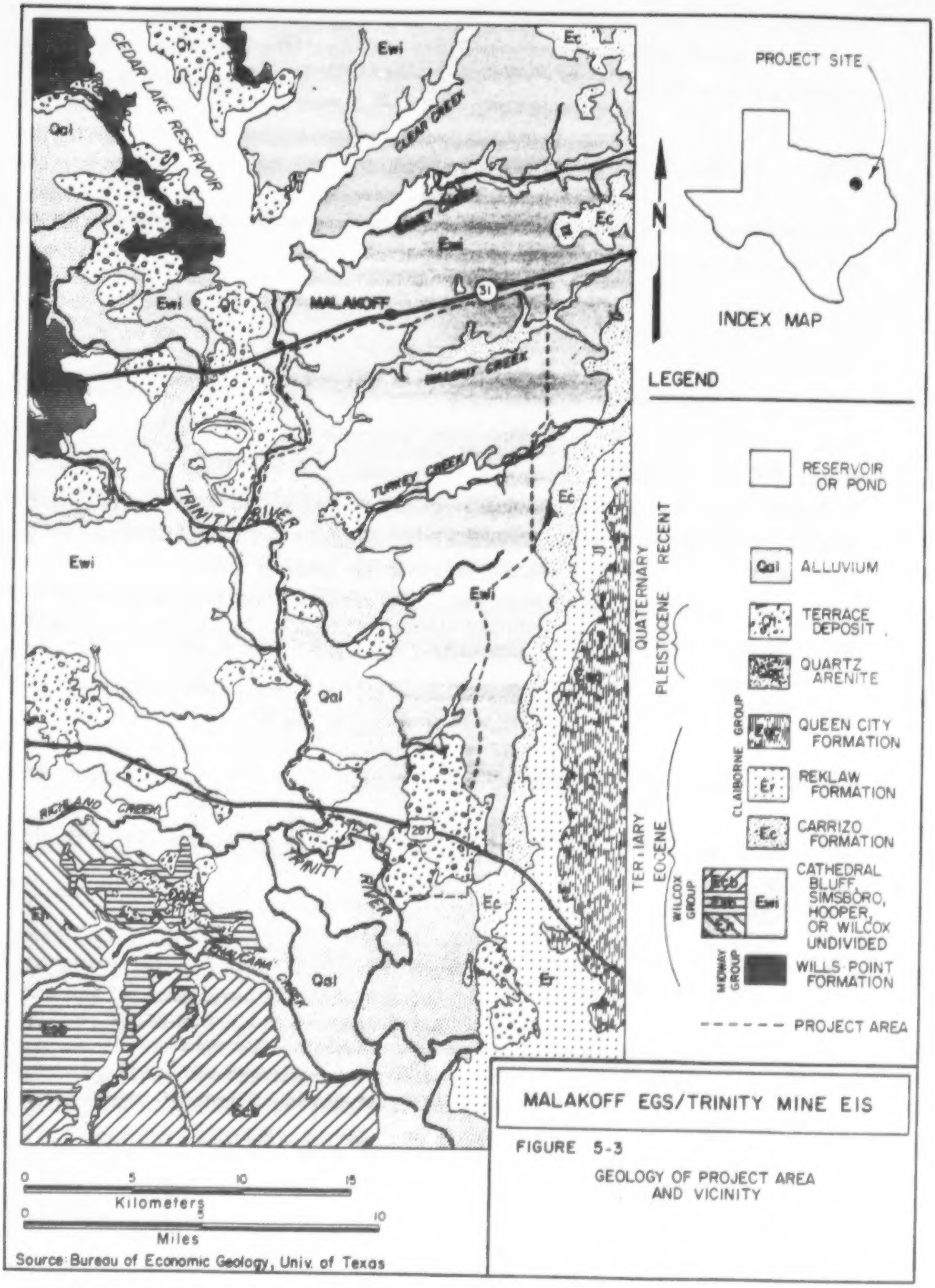
REGIONAL GEOLOGIC STRUCTURE

outcropping deposits of the Midway Group and traverses the region west of the project site.

The proposed project is located within an area of seismic risk labeled as Zone 0 (U.S. Department of Commerce, 1970). This zone is characterized as an area where there exists small to no possibility of damage resulting from the occurrence of earthquakes. Historically, a series of moderate earthquakes centered in the Texas-Louisiana border area in the vicinity of Hemphill, Texas, approximately 225 km (140 mi) southeast of the project area, occurred beginning on April 23, 1964. Intensities of the shocks were V or less on the modified Mercali Scale. This scale measures the effects on people, man-made objects and the earth's surface. Four shocks over a period of six hours affected an area of about 26,000 km^2 (10,000 mi^2) in northeast Texas, Arkansas and Louisiana on March 19, 1957. Intensity of the shocks was estimated at about V with damage limited to a few broken windows and overturned objects in the Marshall-Gladewater region, about 125 km (80 mi) east-northeast ot the project area. The strongest earthquake recorded in the region occurred on January 8, 1891 and had an intensity of VII. The epicenter of this quake was located about 65 km (40 mi) southeast of the project area, in the vicinity of Rusk, Texas (Von Hake, 1977). Based on the geologic and seismic history of the region, it is anticipated that earthquakes will not present a significant impact on project structures or facilities.

The near-surface geologic formations existing within the project area are Lower Tertiary and Quaternary in age and are, in descending stratigraphic order: Quaternary alluvium and terrace deposits, and strata of the Tertiary Age Wilcox Group. Wilcox sediments in the project area consist of 120 to 425 m (400 to 1,400 ft) of sands, silts, clays and lignites. Sediments of the Wilcox Group are mapped as undivided in the site area, but are divided into the upper, lignite bearing Cathedral Bluffs Formation, the middle Simsboro Formation, and the lower Hooper Formation southwest of the project area where delineation of the formations is possible (Fig. 5-3). Generally, individual beds cannot be correlated over long distances because of lateral changes in thickness and lithologic characteristics.

The Cathedral Bluffs Formation is the major lignite-bearing formation in the region. It is deltaic in origin and consists of alternating beds of shale, sandy shale, shaley sand, lignite and sandstone. There are a number of lignite seams present within the project area. Five seams exist at a mineable depth over most of the area, while an additional four or five seams may be mineable in limited areas. A detailed discussion of the mineable lignite reserves is presented in Sec. 4.5.2.1.


CEDAR LAKE RESERVOIR
CLEAR CREEK
MALAKOFF
31
WALNUT CREEK
TURKEY CREEK
TRINITY RIVER
RICHLAND CREEK
287
CHAMBERS CREEK
Qal
Ql
Ewi
Ec
Er
Ecb
Eh
PROJECT SITE
N
INDEX MAP
LEGEND
RESERVOIR OR POND
Qal ALLUVIUM
Qt TERRACE DEPOSIT
QUARTZ ARENITE
Eqc QUEEN CITY FORMATION
Er REKLAW FORMATION
Ec CARRIZO FORMATION
Ecb Esb Eh Ewi CATHEDRAL BLUFF, SIMSBORO, HOOPER, OR WILCOX UNDIVIDED
WILLS POINT FORMATION
PROJECT AREA
QUATERNARY
RECENT
PLEISTOCENE
TERTIARY
EOCENE
CLAIBORNE GROUP
WILCOX GROUP
MIDWAY GROUP
0 5 10 15
Kilometers
0 5 10
Miles

Source: Bureau of Economic Geology, Univ. of Texas

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FIGURE 5-3

GEOLOGY OF PROJECT AREA AND VICINITY

The dip of the stratum is approximately 25 m/km (50 ft/mi) in a southeasterly direction, but may be locally affected by near-surface structural displacements. These structural changes are minor and will not effect the mining operations within the site area.

5.4.2 Impacts of No Action Alternative

There will be no adverse or beneficial impacts to the geology of the proposed project area as a result of the no action alternative.

5.4.3 Impacts of Project Alternatives

5.4.3.1 Impacts of Construction

Power Station. Construction of the power station and associated facilities will result in localized permanent alteration of the surface and shallow subsurface sediments. No significant impacts to geology will occur.

Mine. Construction activities in the mine area will be limited principally to the construction of shop facilities, dragline erection pad and haulroads. The majority of these activities will be confined to the mine ancillary activities area, and impacts to the geological features of the area will be minor.

5.4.3.2 Impacts of Operation

Power Station. There are no known impacts to geology as a result of power station operation.

Mine. Within the mine area, the stratigraphic relationships and the physical characteristics of the individual geologic strata above the lignite will be permanently altered.

Oil and gas production may be temporarily interrupted by proposed mining operations. The extent to which this occurs will be largely dependent on the value and cost of lignite mining (as compared to the value of lost oil and gas production) and agreements reached between the mine owner and effected petroleum companies and/or mineral rights owners. Because oil and gas deposits occur at depths much greater than the lowest mineable lignite seam, wells taken out of production during mining operations can be redeveloped after mining operations are concluded in the area of the well.

NACCO estimates that approximately 76.5 million m^3 (100 million yd^3) of sand and gravel exist within the alluvial material overlying the mineable lignite seams. NACCO is currently evaluating the option of salvaging the sand and gravel during lignite mining operations. The final decision will be based on the availability of a market for the material and the economics associated with mining and selling the sand and gravel resource.

Data from the Bureau of Mines (1977-81) indicate that approximately 45.5 million metric tons (50 million tons) of sand and gravel are mined and sold in Texas each year. Using an average of 1,529 kg/m^3 (2,600 lb/yd^3), the 76.5 million m^3 (100 million yd^3) of sand and gravel estimated by NACCO to lie above mineable lignite seams represents approximately 118 million metric tons (130 million tons) or approximately 2.6 times the annual amount sold in Texas each year. Mining in the alluvium will occur over a period in excess of 30 years. If annual production of sand and gravel remains fairly constant in the state, NACCO's production on an annual basis could be approximately 8.7 percent of the total. However, it should be noted that this assessment is based on a series of assumptions which are speculative at best. These assumptions include:

1) All sand and gravel material in the alluvium within the Trinity Mine is marketable;

2) Annual production of sand and gravel within the Trinity Mine will be reasonably constant;

3) Annual demand for sand and gravel in the state will remain constant;

4) Market forces operating on sand and gravel remain constant; and

5) NACCO can mine the sand and gravel at a cost competitive with current mining operations.

If the sand and gravel is not salvaged during lignite mining, the resource would most probably be lost as a result of dilution with other overburden materials. This could result in an irretrievable loss of the resource.

5.4.3.3 Cumulative

In discussing the cumulative impacts on geology of several power plants and surface mines, it should be first noted that the impact to geology will be limited to the individual project areas and will not extend into adjacent regions. The major adverse impact to the geological resources which could become significant when viewed cumulatively is the preclusion of the development of oil and gas reserves which may underlie the areas undergoing mining activities. Because this adverse impact is not permanent and reserves may be developed when mining activities are completed, this impact is considered minor even when viewed cumulatively with other proposed projects.

5.5 GROUND WATER

5.5.1 Existing Environment

Three principal aquifer systems can be identified in the region. These are the Carrizo-Wilcox, the Queen City and the Sparta aquifers. The major zone of recharge of these aquifers is the outcrop area of the associated formations. The aquifers extend in a down-dip, or south-southeast, direction. In general, the aquifers exist under unconfined conditions in the areas of outcrop and become confined further down-dip where overlain by other deposits. Alluvium within the Trinity River flood plain is saturated and represents a fourth, however minor, aquifer in the region.

The three aquifers are hydraulically separated by aquicludes made up of low permeability clays, shales and limestones. The Carrizo-Wilcox Aquifer is separated from lower aquifer systems by the shales and limestones of the Midway Group. Overlying the Carrizo-Wilcox system is the Reklaw Formation, a mostly clay unit which hydraulically separates the Carrizo-Wilcox from the Queen City Aquifer. Separating the Queen City Aquifer from the Sparta Aquifer is the Weches Formation, and overlying the Sparta Aquifer is the Cook Mountain Formation. Table 5-6 summarizes the regional stratigraphy and the lithologic and water-bearing characteristics of the units. The Carrizo-Wilcox Aquifer and the Alluvial Aquifer are the only ground-water systems in the region which may be affected by operation of the project. The Queen City and Sparta systems do not occur within the project area and are adequately separated from the Carrizo-Wilcox by units of low permeability, therefore, discussion will be limited to the Alluvial Aquifer and the Carrizo-Wilcox Aquifer.

The Carrizo Formation and deposits of the Wilcox Group are two separate geologic units exhibiting different lithologic and hydrologic characteristics. The sands of the Carrizo unconformably overlie the shales and sands of the Wilcox. Occasionally, however, the shales of the Upper Wilcox are not present, thus allowing the sands of the Carrizo to be in

TABLE 5-6
GENERAL STRATIGRAPHIC RELATIONSHIPS IN REGION

System	Series	Stratigraphic Unit	Approximate Range in Thickness (meters)	Lithologic Characteristics	Water-bearing Characteristics
Quaternary	Recent or Pleistocene	Alluvium or terrace deposits	0-15	Silt, sand and gravel.	Yields small quantities of fresh to brackish water to wells in the flood plain of Trinity River.
Tertiary	Eocene	Cook Mountain Formation	0-40	Shale, marl and sand with some limestone, gypsum and glauconite.	Yields little to no water.
		Sparta Sand	0-80	Thickly bedded sand in lower part of formation; thinly bedded silty sand and sandy shale in upper part.	Yields small to moderate supplies of fresh water.
		Weches Formation	0-50	Glauconitic sand, shale, limestone and marl.	Yields little to no water. Water contained in formation generally of poor quality.
		Queen City Sand	0-170	Fine- to medium-grained sand interbedded lignitic and sandy shale.	Yields small to moderate supplies of fresh water.
		Reklaw Formation	0-95	Predominantly shale in upper part of formation and sand in lower part.	Little water supplied from upper part. Lower part yields small amounts of fresh water in association with underlying Carrizo-Wilcox Aquifer.
		Carrizo Formation	0-120	Fine- to medium-grained sand and shale.	Yield small to moderate supplies of fresh to brackish water.
		Wilcox Group	0-760	Cross-bedded sand, lignitic clay, lignite lentils and silt.	Yields small amounts of water, slightly saline to fresh.
		Midway Group	0-275	Shale, clay, sand and silt.	Little to no water.

direct contact with the sands of the Wilcox, hydrologically connecting the two units. The most prolific water-bearing zone of the Carrizo-Wilcox Aquifer is the Simsboro Formation. The Simsboro, however, is absent north of the Trinity River and is, therefore, not associated with the deposits within the project boundaries.

Recharge to the Carrizo-Wilcox Aquifer occurs along its area of outcrop which ranges in width from 20 km (12 mi) in Henderson County to about 35 km (22 mi) in Freestone County. Unconfined conditions exist in the aquifers outcrop area, with the direction of water movement generally toward the Trinity River where waters are discharged naturally through springs and seeps and by evapotranspiration. Where the aquifer is confined, the movement is in a down-dip, or southeast, direction (Peckam et al., 1973).

Alluvial deposits of sand and gravel exist along the Trinity River and furnish water for small industry, domestic and livestock use throughout the region. In general, however, water from this source is very limited and is not depended upon as a long-term or a high-capacity water supply (Peckham et al., 1973).

Regionally, the quality of water contained in the Carrizo-Wilcox Aquifer is fresh in the area of outcrop, i.e., less than 500 parts per million (ppm) total dissolved solids (TDS), and becomes increasingly saline, over 1,000 ppm TDS, in a down-dip direction. Water in the Carrizo portion of the system generally has a concentration of TDS less than 200 ppm. Concentrations of TDS in water obtained from wells located in Anderson and Cherokee counties (southeast of the project area) range from 500 to 1,000 ppm. The quality of water obtained from the alluvial aquifer system varies from place to place. In general, the water quality can be expected to range from 500 to 3,000 ppm concentration of TDS (Guyton, 1972).

Sediments of the Wilcox Group underlie the entire proposed mine area. Approximately one-quarter of the mine area lies within the flood plain of the Trinity River where alluvial sediments uncomformably overlie Wilcox material. Within the proposed mine area, the Wilcox consists of a complex system of water-bearing, undifferentiated, interbedded sands, silts and clays. Wilcox sediments both above and below the lignite are considered to be aquifers.

The ground-water flow system within the project area and vicinity is both confined and unconfined and is bounded on the west by the Trinity River and on the east by the surface water drainage divide of the Trinity and Neches rivers. The principal direction of ground-water movement is essentially downward at the divide, with the horizontal components of flow becoming increasingly dominant toward the Trinity River. A ground-water sink exists at the river and upward flow is dominant.

Although no significant recharge areas exist within the project area, aquifer recharge occurs from direct infiltration of precipitation falling on the surface, lateral inflow from adjacent sediments of the Carrizo-Wilcox Aquifer, and vertical leakage from the overlying alluvium. Discharge from the aquifers occurs as leakage in the form of seeps and springs into the rivers and streams of the area and lateral flow into adjacent sediments of the Carrizo-Wilcox Aquifer down-dip of the area. Also, some leakage into overlying semipervious layers occur. Leakage downward within the area is inhibited by low permeability clay units underlying most of the lignite.

Ground-water quality within the project area varies considerably. TDS concentrations of the ground water within the Wilcox Formation and the alluvial material range between 500 and 3,000 ppm. High TDS concentrations are due largely to the high sodium and chloride concentration in the ground water.

To further define the ground-water flow system within the project area, a total of five aquifer pumping tests was conducted by NACCO in the vicinity of the proposed mine area. Data analysis was conducted by P. J. Riordan (1979) and consisted of initial plotting of drawdown data (corrected for time lag and/or barometric influences) and matching standard non-equilibrium type curves, selecting the best fit, and computing various aquifer parameters. Hydraulic conductivities ranged from 1.34×10^{-4} to 1.26×10^{-3} cm/sec (0.38 to 3.58 ft/day) in the Wilcox sediments, and ranged from 0.23 to 0.81 cm/sec (646 to 2,308 ft/day) in the alluvium. Storage coefficients for the Wilcox material ranged from 1.2×10^{-3} to 5.9×10^{-4}, and specific yields of the alluvium range from .02 to .14.

Aquifers provide limited quantities of ground water which is used throughout the project area and vicinity. Two major systems of wells occur in the region, one in the City of Malakoff (north of the project area) and the other in Athens (northeast of the project area). The Malakoff well system consists of three wells with yield estimates of 0.75 m^3 per min (200 gpm).

The Athens well system consists of five wells with yield estimates of 0.75 to 0.95 m^3 per min (200 to 250 gpm). The primary water supply for Athens currently is provided by Lake Athens with ground water providing a secondary source. Pumpage is currently at about 20 percent of the estimated potential yield of the wells.

Aquifers provide a potable supply of water throughout the project area, mostly for domestic use. A water well inventory of the permit area conducted by NACCO in 1982 located 244 ground-water wells within the project boundary (Fig. 5-4). Of these, approximately 60 percent are currently providing supplies for domestic, livestock and irrigation use. Information was not available for about 20 percent of the wells in the area. The remainder provided water for industrial use, municipal water supply or were abandoned or not currently being used. Wells ranged in depth from 6.1 m (20 ft) to 1,280 m (4,200 ft), with more than 85 percent of the wells drawing water from units underlying the mineable lignite.

The potentiometric surfaces for the aquifers in the upper aquifer system at the Trinity Mine site are generally within 10 ft of each other along a given vertical profile. In addition, water levels for the aquifers within the upper aquifer system in the project area may fluctuate as much as 10 ft during the course of a year. At times, the potentiometric surface for the aquifer below the lowest mineable lignite seam is equal to or higher than the near surface aquifer during certain times of the year. At other times, the converse is true. The potentiometric surface as shown in Fig. 5-4 is the best representation of the available data and realistically reflects the general direction of ground-water flow for the upper aquifer system within the project area.

5.5.2 Impacts of No Action Alternative

There will be no adverse or beneficial impacts to the local or regional aquifer systems as a result of the no action alternative, except for sand and gravel operations in the alluvium. The basal sand and gravel strata of the alluvium, which is an aquifer, will be destroyed in an area of approximately 1,025 ha (2,500 ac), resulting in an irretriveable long-term, adverse impact.

5.5.3 Impacts of Project Alternatives

5.5.3.1 Impacts of Construction

Power Station. During the construction period, HL&P proposes to install a well system to supply from 100 to 200 gpm of ground water. Pumping will cause a reduction of the

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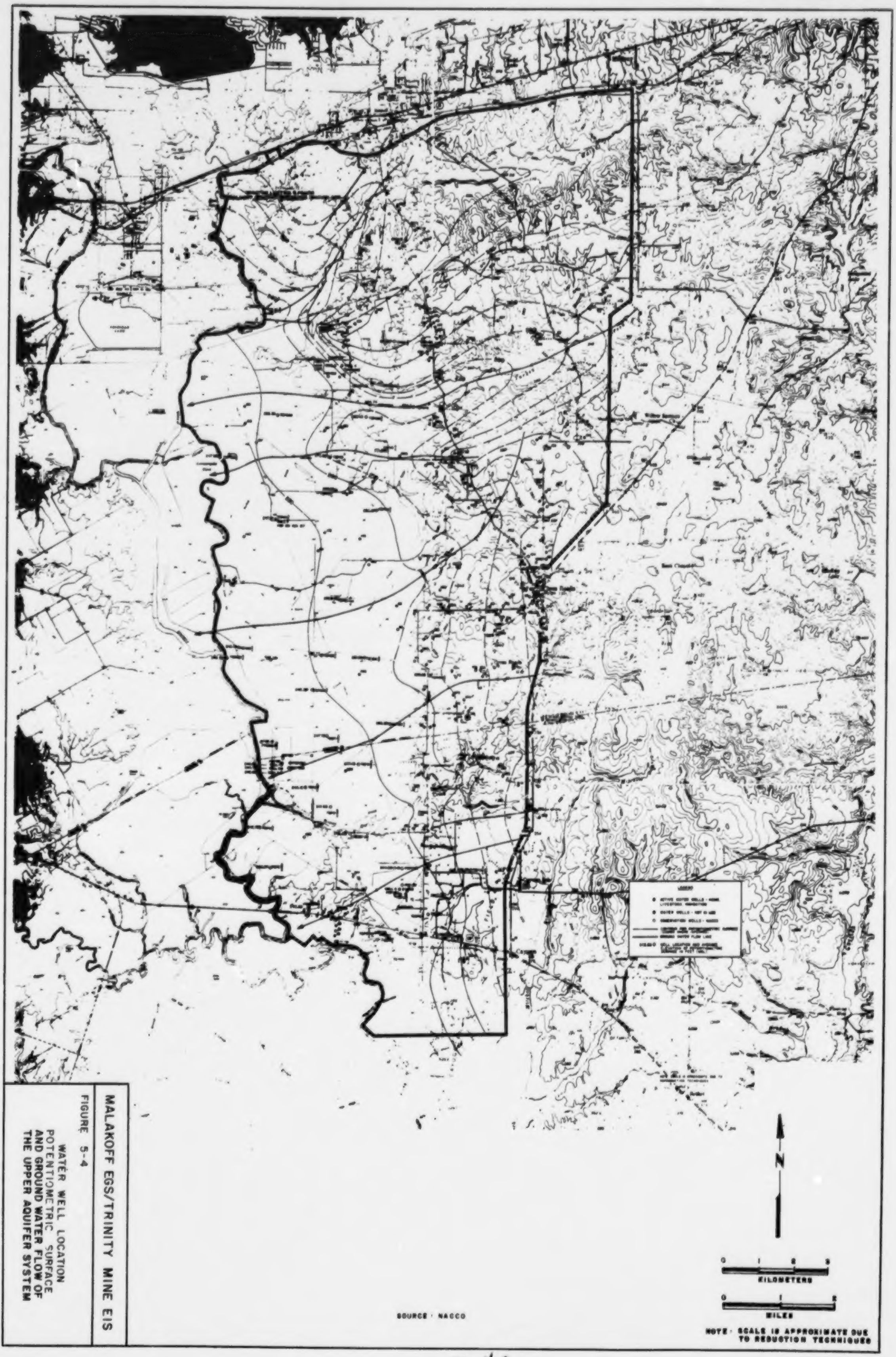
N
0 1 2 3
KILOMETERS
0 1 2
MILES

SOURCE: NACCO

NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-4

WATER WELL LOCATION POTENTIOMETRIC SURFACE AND GROUND WATER FLOW OF THE UPPER AQUIFER SYSTEM potentiometric surface for some distance from the proposed HL&P wells. The amount of drawdown and the areal extent of the cone of depression will overlap with the drawdown presently occurring as a result of ground water withdrawal by the City of Malakoff. The reduction in water level could potentially produce a drawdown at the City's wells of 6.1 to 15.2 m (20 to 50 ft).

Mine. Construction of mine facilities will result in some disturbance of surface and shallow subsurface material over a relatively small area, but will not result in impacts to the ground-water system.

5.5.3.2 Impacts of Operation

Power Station. The makeup water will be stored in a clay-lined pond thus inhibiting infiltration of water into the subsurface. The lignite storage and handling area will be surrounded by trenches which will convey runoff from the area to a lined runoff collection pond where the water will be treated prior to either release into the surface water system or reuse on site. The solid waste landfill area will be lined with low permeability material, thereby inhibiting infiltration and reducing the potential of leaching.

As described above, all areas having a potential for ground-water contamination will be lined with low permeability material which will inhibit the infiltration of poor quality water into the ground-water system. Therefore, there will be no adverse impacts to the ground-water quality of the area as a result of the power plant operation.

During operation, a maximum of 50 gpm of ground water will be used. Pumping will cause a reduction of the potentiometric surface for some distance from the proposed HL&P well. The reduction in water level could potentially produce a drawdown at the City of Malakoff's wells, but less than that potentially occurring during construction.

Mine. Because of the fluvial nature of the Wilcox deposits, extensive horizontal and vertical aquifers can only be conceptualized on a regional basis. Locally, regional aquifers are more accurately envisioned as a series of sand lenses or stringers with little to no hydraulic connection with adjacent, underlying or overlying lenses or stringers. For this reason, disturbing the near surface water bearing units would not impact the deeper and unassociated zones.

The most obvious impact of the mining operation concerns the water wells in the mining area which will be abandoned or removed during mining or construction activities. It is estimated that approximately 75 percent of the ground-water wells within the project area will be eliminated by the mining activities. Only a small percentage of these wells, however, are actually completed into material which will be removed during mining. After reclamation, all wells can be replaced and completed into water-bearing zones below the limit of mining which will be unaffected. Section 351 of RRC regulations requires that:

> Any person who conducts surface mining activities shall replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where the water supply has been affected by contamination, diminution, or interruption proximately resulting from the surface mining activities.

When a well is not eliminated by excavation, it may be subject to a water-level drawdown dependent upon the depth of mining and distance the well is from the excavated pit. In general, when excavation occurs to any level below the potentiometric surface of the saturated sediments, movement of ground water in the vicinity of the mine may be expected to be toward the open cut and/or its dewatering system. For any given mine cut, the volume of ground-water inflow and area influenced by ground-water dewatering and/or depressurizing will vary and depend upon the following variables:

1) depth of active cut;
2) duration of cut;
3) position of potentiometric surface(s);
4) exposed aquifer thickness;
5) aquifer permeability;
6) aquifer storage coefficient; and
7) methods of dewatering.

During mining, the quantity of ground water removed due to dewatering and/or depressurizing will vary, and withdrawal rates will depend upon the ground-water conditions and control methods employed at any given time at the mine. Dewatering in the mine will be achieved, in most cases, with sump pumping systems along the highwall. Ground water which seeps into the pit by gravity drainage through the highwall or pit floor will be pumped out of the pit. Highwall seepage rates were estimated (Depts. of the Army, Navy and Air Force, 1971) and yields from Wilcox sediments were computed to range from 24 to

73 gpm per 1,000 ft of highwall for boxcut situations. A seepage rate in alluvial material was estimated to be approximately 1,400 gpm per 1,000 ft of highwall for boxcut situations. These calculations assumed a saturated thickness of 15.2 m (50 ft) and maximum permeability values as determined from pumping tests. In special cases (i.e., cuts in alluvial deposits where the highwall may not be stable and have a seep face) wells, well points and/or other devices will be employed to assist in the dewatering/depressurization. Withdrawal rates were estimated at 300 gpm initially, decreasing to 100 gpm after several years of dewatering/depressurization activities.

The primary result of the dewatering and/or depressurizing operation will be a general lowering of ground-water levels over the area, thereby decreasing the yield of wells within the area of influence of the cone of depression created by the operation. Although the net water level reduction and the areal extent of influence for any given mine cut will depend upon the variables aforementioned, a range of estimates can be calculated to illustrate the various conditions which may be encountered in the mining area. To assess the extent of influence of pit dewatering, the following gravity flow formula was utilized:

$$R = C\,(H - h_w)\sqrt{K}$$ (from Depts. of the Army, Navy and Air Force, 1971)

where,

R = the radius of influence.

$H - h_w$ = total drawdown; for the purposes of these calculations total saturation of overburden is assumed, therefore H is equal to overburden thickness (or depth of mining) and h_w is assumed to equal 0 for a "worst case" analysis.

K = coefficient of permeability.

C = coefficient for gravity flow. Assumed 3.0 to obtain a "worst case" analysis.

This analysis assumes a homogeneous, totally saturated overburden, and examines a range of permeabilities based upon the results of aquifer pumping tests performed within the mine area (as reported in Sec. 5.5.1) and a range of mining depths from 3 to 53 m (10 to 175 ft). The results, compiled in Table 5-7, express the distances from the mine pit that the water table will be impacted (i.e., the distance to zero drawdown).

As the table illustrates, the maximum distance of impact to the water table elevation resulting from mining in Wilcox material will be less than 0.8 km (0.5 mi). The radius of influence is considerably greater in the alluvial material, as is expected. However, the

TABLE 5-7

RADIUS OF INFLUENCE OF PIT DEWATERING FROM SURFACE MINING OPERATIONS[a]

Saturated Overburden Thickness (ft)[a]	Permeability (x 10^{-4} cm/sec)			
	1.340[b]	6.970[b]	12.600[b]	5200.000[c]
10	35 ft	79 ft	106 ft	2,163 ft
25	87 ft	198 ft	266 ft	5,408 ft
50	174 ft	396 ft	532 ft	10,817 ft
75	260 ft	594 ft	799 ft	16,225 ft
100	347 ft	792 ft	1,065 ft	21,633 ft
125	434 ft	990 ft	1,331 ft	27,042 ft
150	521 ft	1,188 ft	1,597 ft	32,450 ft
175	608 ft	1,386 ft	1,864 ft	37,858 ft

a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

b. Range of permeabilities determined from pumping tests conducted in Wilcox material.

c. Average permeability in alluvial material.

thickness of alluvial overburden to be mined will only be about 12 m (40 ft) maximum, which occurs along the southwest boundary of the mine. Therefore, the calculated distance to zero drawdown in this material is between 1.6 and 3.2 km (1 and 2 mi), however, the water well inventory conducted by NACCO does not indicate any ground-water wells located in the vicinity of this portion of the mine area (Fig. 5-4). This water well inventory further indicates that approximately 85 percent of the water wells are completed into water bearing units well below the lowest recoverable lignite seam. All municipal or public water supply wells in the area are completed in the deeper aquifer. The few wells which are completed into the upper aquifer system are generally utilized for livestock watering.

In summary, this analysis indicates that those ground-water wells within the mine boundary which are not destroyed by the mining operation will probably be impacted to some extent due to the dewatering activities. Water wells producing municipal supplies will not be affected, however. Adverse impacts to the productivity of ground-water wells lying outside the mine boundary will be minimal and short term in nature as water levels at these wells are expected to recover shortly after mine dewatering ceases.

As previously discussed, mine dewatering will occur through highwall seepage, pumping ahead of mining, depressurization of sediments underlying mineable lignite, or a combination of each of these. Water control systems for the mine as well as seepage rates into the pit were evaluated using hydraulic parameters obtained from pumping tests. Seepage from highwalls was calculated using the equation for combined artesian-gravity flow.

Once mining and dewatering have been completed, spoil will be subject to resaturation. There are three potential sources of water for resaturation of the mine: 1) infiltration of precipitation; 2) upward leakage from sand bodies beneath the mine; and 3) inflow from sand bodies adjacent to the mine.

Postmining recharge rates from precipitation may be slightly increased over present rates because overall vertical permeability of reclaimed spoil will be slightly greater than existing stratified overburden. Horizontal stratification of existing overburden will be destroyed during mining and will tend to increase vertical permeability while reducing horizontal permeability. Also, depending upon surface reclamation techniques, surface infiltration will increase proportionately to the extent that potential surface runoff will decrease (see Sec. 5.6.3.2). Recharge from underlying aquifers may increase slightly due to the removal of existing lignite horizons presently retarding vertical ground-water flows from lower aquifers.

The mining operation will also result in the alteration of horizontal stratification of the overburden materials. The horizontal permeability and transmissivity is expected to be reduced, causing a reduction in the lateral flow through the cast overburden material. With respect to inflow of ground water from adjacent sand bodies, it is anticipated that inflow will be slower because the horizontal permeability will be lower than the undisturbed premine overburden (Kennedy, 1981). From studies by Schneider (1977) in eastern Texas on the effects of settlement of cast overburden on its permeability, it may be surmised that the permeabilities in the reclaimed areas will decrease with increasing depth through the cast overburden.

In general, aquifer productivity in reclaimed spoil areas containing shallow ground-water supplies is expected to be diminished in terms of the maximum possible yield due to the decrease in the horizontal permeability of the overburden material. Upon resaturation of the spoil material, wells placed in the reclaimed area may be unable to produce at average yields typical of premining usage. However, the use of significantly greater screened intervals of wells placed in the resaturated overburden may produce yields close to pre-mining conditions. The amount of decrease in maximum yield will also depend upon the interrelationship of altered ground-water levels and changes in aquifer storage characteristics.

The ground-water system in the reclaimed spoil is expected to recover slowly following mining and reclamation. Pepper (1980) found that reclaimed mined land had not become fully saturated after eight years. Under conditions of forced recharge from a deep large pond, resaturation may occur within 10 to 20 years after mining (Pollock, 1982). Under normal recharge conditions, it is anticipated that the time required for resaturation of mine spoil could be significantly greater (35 to 50 years) (Mathewson et al., 1982).

As a result of the mining operations, mixed overburden material will be subject to oxidation processes. The exposure of many mineral assemblages to oxidation will result in their alteration and partial dissolution when contacted by runoff or infiltration of surface or ground water. The concentration of any dissolved ion species that may occur as a result of leaching of the cast overburden material at any particular place or time will depend upon the following variables:

1) rate, volume and composition of recharge water;
2) nature, rate and extent of chemical alteration of the cast overburden;
3) composition and volume of surrounding ground water; and
4) duration of contact of recharge water with altered cast overburden.

Overburden that lies below the existing water table exists under anaerobic (chemically reducing) conditions. Once the water table is lowered by dewatering, and the overburden is excavated and replaced as spoil, the material is exposed to the atmosphere and oxidizing conditions. In this new environment, certain mineral species are susceptible to chemical alteration to a leachable form. The parameter of greatest concern in postmine ground-water quality is total dissolved solids. Most notably, the constituent that will contribute to total dissolved solids is sulfate. The other constituents contributing to total dissolved solids (e.g., chloride, sodium, calcium) are associated with taste preferences.

Other less common elements, such as the heavy metals, may become mobilized if pH of the overburden is lowered to 4.0 or less through oxidation of iron disulfides. It should be noted that the trace element (heavy metal) concentrations within the five cores analyzed are low and fall within the range normally occurring within agricultural soils. Because the possibility exists for pyritic material to find its way to the surface, especially for the random overburden mix alternative, a "worst case" analysis was conducted which assumed complete oxidation of the pyrites present within a 0.7-m (2.3-ft) thick layer (found in only one core). The assumption was also made that the highest potential acidity occurs at the surface increasing solubility of trace elements, leaching them downward, beneath the surface soils into layers below. Analyses of the available core data indicate that excess neutralization potential of the underlying spoil layers would neutralize the acidity produced by the oxidation of pyrites on the surface. The majority of the trace elements made soluble by pryite oxidation are cations which would be absorbed by the exchange complex of the material immediately beneath the surface.

Another possible cause of spoil acidification would originate from the entrapment of atmospheric oxygen in the spoil material during stripping, backfilling and leveling operations. An additional "worst case" analyses was therefore performed which assumed complete exposure of all spoil material to the atmosphere, a 1.5 gram per cubic centimeter bulk density throughout the overburden profile, and a 20 percent oxygen content of the atmosphere. The analyses showed that only 81 to 90 kg (180 to 200 lb) of $CaCO_3$ per acre-six inches would be required to neutralize the acidity produced by the oxygen present in the void spaces. Again, the excess neutralization potential of the spoil, as shown in Table 5-5, would obviate any deleterious effect caused by the small amount of acidity produced. Therefore, no increase of heavy metals concentrations in the ground water found within the resaturated mine spoil is anticipated.

Table 5-8 presents a comparison of USEPA Interim Primary and Secondary Drinking Water Standards with ground-water samples collected within the upper aquifer system at the Trinity Mine. Review of the data indicates that concentrations of chloride, sulfate and

TABLE 5-8
COMPARISON OF USEPA INTERIM PRIMARY AND SECONDARY DRINKING WATER STANDARDS TO EXISTING GROUND-WATER QUALITY IN THE UPPER AQUIFER SYSTEM

	USEPA Interim Primary & Secondary Drinking Water Standards	Above Lignite Well #4	Below Lignite Well #3	Alluvium Well #IC	Alluvium Well #5	Below Lignite Well #6
pH (pH units)	6.5-8.5	6.7	8.3	7.5	6.7	8.5
Chloride	250	510	32	140	1,280	62
Floride	1.8	0.43	0.39	0.37	0.39	0.33
Nitrate	10	<.08	0.27	<.08	4.2	0.49
TDS	500	1,524	532	796	2,780	632
Sulfate	250	354	<1	295	206	1.0
Arsenic	0.05	<.005	< .005	0.01	< .005	0.01
Cadmium	0.01	<.004	< .007	<.006	< .006	0.01
Chromium	0.05	<.01	< .01	<.01	< .01	<.006
Lead	0.05	<.1	< .1	<.1	< .1	<.01
Iron	0.3	3.6	0.29	0.05	0.04	<.01
Manganese	0.05	4.94	< .01	0.02	0.04	0.61
Mercury	0.002	0.0030	0.0006	0.0002	0.0004	0.41
Selenium	0.01	<.5	< .5	<.5	< .5	<.0002
Zinc	5.0	0.19	0.11	0.08	0.14	<.05
Copper	1.0	0.05	0.06	0.67	0.06	0.07

All values reported in mg/l unless indicated otherwise.

< Indicates below detectable limit of laboratory analyses performed.

total dissolved solids currently exceed the EPA secondary standards, however, heavy metal concentrations are generally lower than the primary standards.

Given the chemical makeup of the overburden material, and the low levels of trace elements, it is expected that water from wells drilled after mining would be of equal quality and could provide the same uses as those utilized under premining conditions. As discussed previously, it is anticipated that resaturation of mine spoil will occur over a period of 10 to 50 years.

After ground-water recovery, the shallow subsurface flow within the cast overburden and seepage into the Trinity River-Cedar Creek Cutoff systems should resume as per premining conditions. Average annual flow for these systems after reclamation is expected to be less than the present total seepage rate of 2.9×10^6 m^3/yr. In comparison to the combined average annual discharge of 3.3×10^{11} m^3 per year from Cedar Creek Reservoir (5.1×10^8 m^3) and the Trinity River at Trinidad (3.2×10^9 m^3) (EH&A, 1982), ground-water seepages rates are small. However, ground-water seepage from reclaimed overburden materials will be less than .001 percent $((2.9 \times 10^6\ m^3/3.3 \times 10^{11}\ m^3)) \times 100$ of the total rate of discharge for the Trinity River and Cedar Creek drainages. Therefore, no surface water quality effects would be expected from ground-water seepage because seepage rates are negligible with respect to the overall surface water discharge from these river systems. Also, it is not expected that the migration of ground water from reclaimed overburden materials into adjacent water-bearing sediments will occur to any great extent because the general direction of ground-water flow within the project area is toward discharge points along the surface water drainages. Therefore, it is anticipated that neither surface-water contamination nor ground-water contamination will be a significant adverse impact resulting from the project.

5.5.3.3 Cumulative

The cumulative impacts of several power plants and surface mines on the ground water are difficult to delineate because of several factors. These factors include: the distances between the projects; the low velocity of ground-water flow; and the numerous natural forces which are associated with the replenishment and flushing of the ground-water resources. Collectively, the projects could impact large amounts of ground-water reserves creating long-term impacts on individuals competing for the resource, particularly if the ground-water reserve is being depleted faster than it can be recharged. In addition, with respect to ground-water quality, long-term impacts may go beyond the project's lifetime because of the required time necessary for the natural processes of flushing the ground-water system and improving any degradation resulting from mining. Therefore, a cumulation of individual impacts from increased mining activities could increase the potential for the ground-water resources to be adversely impacted. However, the radius of influence of dewatering associated with mining in the Wilcox or similar sediments is expected to be less than 3.2 km (2 mi), even for a "worst case" simulation. At this time, there are no proposed projects located in the proximity of the Malakoff EGS/Trinity Mine Project such that the cones of depressions created could overlap, thereby increasing the total impact on the ground-water system. Also, impacts to the ground-water quality resulting from mining operations typically will reduce with increasing distance from the mine. Dispersion mechanisms and the natural flushing of ground-water generally limits the area of impact to within 1.6 km (1 mi) of a project. Again, there are no proposed projects in the proximity of the Malakoff EGS/Trinity Mine Project that could cause a cumulative impact to ground-water quality. In summary, because of the distances involved between the individual proposed mining projects, an overlapping of adverse impacts is not expected and the Malakoff EGS/Trinity Mine Project will not contribute to total cumulative impacts in the region.

5.6 SURFACE WATER

5.6.1 Existing Environment

Detailed investigations of the surface-water hydrologic and water quality characteristics of the Malakoff EGS/Trinity Mine Project area are documented in the reports "Surface-Water Hydrology of the Malakoff Electric Generating Station" (EH&A, 1982a) and "Surface Water Input to the Trinity Mine EIS" (NACCO, 1982a). The following paragraphs provide a summary of the primary surface water features of the area based on these investigations.

5.6.1.1 Major Surface Water Features

The Malakoff EGS/Trinity Mine site is located entirely within the Trinity River Basin, generally paralleling the east bank of the Trinity River for a distance of approximately 41.9 km (26 mi) in Henderson and Anderson counties, Texas. As the ultimate receiving stream for power station and mine runoff and discharges, either directly or via several tributaries, the Trinity River is the primary surface water feature of the project area.

Other major streams in the project area, all of which are primary or secondary tributaries of the Trinity River, include Cedar Creek, Walnut Creek, Turkey Creek, Prairie Creek and Wildcat Creek. The Henderson County Levee No. 3 protects a large area to the east of the Trinity River, including much of the mine site, from Trinity River flooding, while upland sections of the levee divert local tributaries around the protected area. Streams in the project area flow generally in a westerly or southwesterly direction toward the Trinity River, except for the streams diverted by the upland sections of the Henderson County Levee No. 3 (e.g., Turkey Creek and Prairie Creek). Drainage to the Trinity River from the area protected by the levee system is provided by two 182.9-cm (72-in.) conduits with flap gates located near the southwestern corner of the levee. Four SCS floodwater-retarding structures are located within the project area. These structures provide both runoff control and sediment storage for the purpose of reducing downstream damages. The major surface water features of the Malakoff EGS/Trinity Mine Project area are shown in Fig. 5-5.

5.6.1.2 Climatic Information

The climate in the vicinity of the Malakoff EGS/Trinity Mine is characterized by hot summers and mild winters. During the winter, temperatures average 10°C (50°F), with an average daily minimum temperature of 3.9°C (39°F). During the summer, the average temperature is 27.8°C (82°F), and the average daily maximum temperature is 34.4°C (94°F). Temperatures range from less than -12.2°C (10°F) to as much as 43.3°C (110°F) (SCS, 1979). Rainfall is distributed throughout the year, with the maximum monthly precipitation generally occurring in the spring and fall months and the minimum occurring in July and August. Thunderstorms occur on an average of about 50 days of the year, with most occurring in the spring. The maximum daily precipitation recorded near Trinidad is 14.5 cm (5.70 in.), measured at the Trinidad Power Plant on May 10, 1968. On the same day, 17.5 cm (6.90 in.) were recorded at Athens, Texas, about 16.1 km (10 mi) east-northeast of the project site. The average annual precipitation at Trinidad and Trinidad Power Station during the period 1915-1978 averaged approximately 96.5 cm (38 in.), varying from 55.6 cm (21.9 in.) in 1917 to 150.6 cm (59.3 in.) in 1946 (TNRIS, 1981). Average rainfall intensity as a function of storm duration and recurrence interval for the project area is plotted in Fig. 5-6. These rainfall intensity-duration-frequency curves were based on data obtained from the U. S. Weather Bureau's Technical Paper 40, entitled "Rainfall Frequency Atlas of the United States" (Hershfield, 1961) for storm durations from 30 minutes to 24 hours, and on the Texas Highway Department's Hydraulic Manual (THD, 1970) for storm durations between 10 and 30 minutes. Snowfall is infrequent, with

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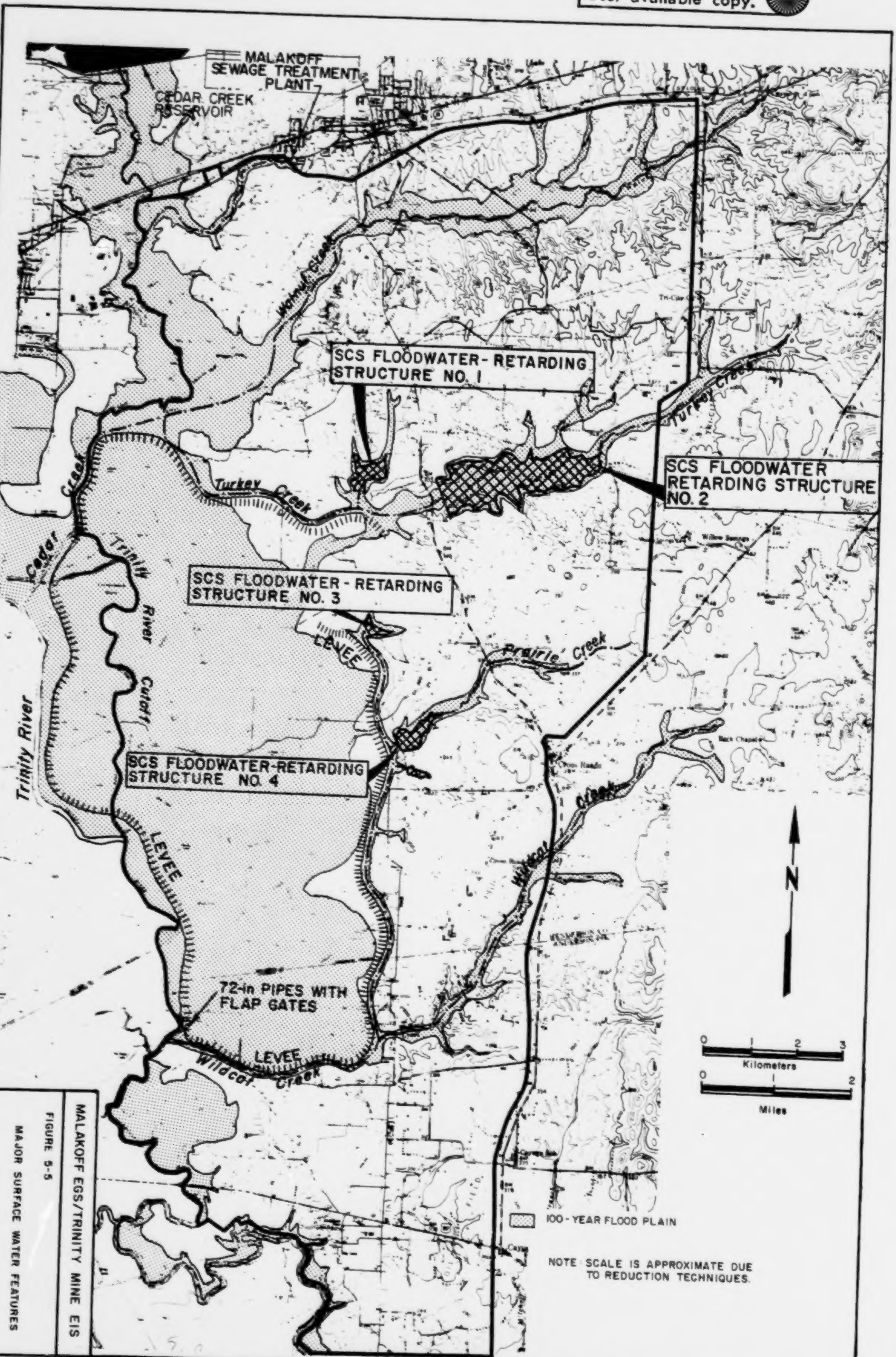
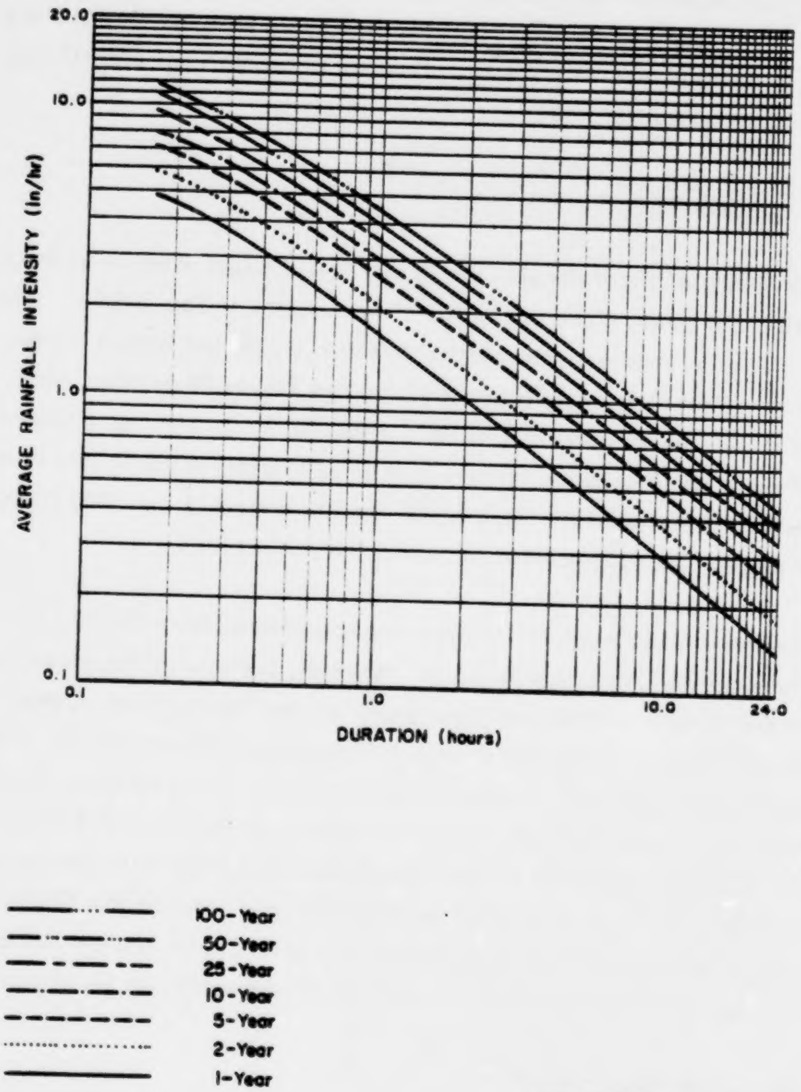

MALAKOFF SEWAGE TREATMENT PLANT
CEDAR CREEK RESERVOIR
Walnut Creek
SCS FLOODWATER-RETARDING STRUCTURE NO. 1
Turkey Creek
SCS FLOODWATER RETARDING STRUCTURE NO. 2
Turkey Creek
Cedar Creek
Trinity River Cutoff
SCS FLOODWATER-RETARDING STRUCTURE NO. 3
LEVEE
Prairie Creek
Trinity River
SCS FLOODWATER-RETARDING STRUCTURE NO. 4
LEVEE
Wildcat Creek
N
0 1 2 3
Kilometers
0 1 2
Miles
72-in PIPES WITH FLAP GATES
LEVEE
Wildcat Creek
▨ 100-YEAR FLOOD PLAIN
NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES.

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-5

MAJOR SURFACE WATER FEATURES



MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-6

RAINFALL INTENSITY vs.
DURATION vs.
RECURRENCE INTERVAL

accumulations in excess of 5.1 cm (2 in.) occurring in only 20 percent of the years, and with no measurable snowfall in about 60 percent of the years (SCS, 1979).

Annual net reservoir evaporation at the project site can be expected to average about 82.3 cm (2.7 ft) per year, varying from about 27.4 to 140.2 cm (0.9 to 4.6 ft). Average monthly net reservoir evaporation varies from approximately 1.22 cm (0.04 ft) during January and February to approximately 17.1 cm (0.56 ft) during July and August. Maximum monthly net evaporation of as much as 30.5 cm (1.0 ft) may occur in dry summer months (TNRIS, 1981).

5.6.1.3 Topography

The topography of the Malakoff EGS/Trinity Mine Project area varies from nearly level to undulating and steep, dissected by the streams noted in Sec. 5.6.1.1. The power station site is located primarily on the plateau between Cedar and Walnut creeks, while the mine site encompasses flat areas formerly within the Trinity River flood plain, which are now protected by the Henderson County Levee No. 3, as well as adjacent upland areas. Elevations range from approximately 75.8 m (250 ft) msl in the Trinity River flood plain in the southeastern corner of the project area to over 121.3 m (400 ft) above msl in the upland areas in the northeastern portion of the project area.

As noted previously, much of the mine site is protected from flooding on the Trinity River by the Henderson County Levee No. 3. However, portions of the project area are located within the designated 100-year flood plains of the Trinity River, Cedar, Walnut, Turkey, Prairie and Wildcat creeks and unnamed tributaries of these streams. Figure 5-5 depicts the approximate 100-year flood plain boundaries for these streams in the project area as shown on flood hazard boundary maps available from the Federal Emergency Management Agency (FEMA). The flood hazard boundary maps show areas protected by Henderson County Levee No. 3 to be within the 100-year flood plain of the Trinity River. NACCO proposes to seek a Letter of Map Amendment from FEMA in order to remove the "special flood hazard area" designation from protected areas within the levee system.

5.6.1.4 Hydrologic Records

Streamflow records for Cedar Creek and the Trinity River are available from the U. S. Geological Survey (USGS). Gaged streamflow records are not available for other streams located within the immediate project area. However, gaged records for other watersheds in the general vicinity of the Malakoff EGS/Trinity Mine are believed to be suitable for use as prototypes for determining some of the hydrologic characteristics of smaller streams in the area.

Trinity River. Streamflow records for the Trinity River at Trinidad (USGS Gage 08062700) have been maintained by the USGS since October 1964 (Table 5-9). Flow at Trinidad is affected by storage in several upstream reservoirs having a combined capacity of 4,406,015,564 m^3 (3,572,000 ac-ft), of which 1,403,708,206 m^3 (1,138,000 ac-ft) are designated for flood control. Additionally, the cities of Fort Worth and Dallas, as well as several smaller cities, divert large quantities of water for municipal use, of which about 60 percent is returned as sewage effluent, helping to sustain low flows at Trinidad (USGS, 1980a).

Spillway outflows from Cedar Creek Reservoir on Cedar Creek upstream of the project area enter the Trinity River 20.9 km (13 mi) upstream of the Trinidad gaging station, thus adding to flows during periods of flooding in the Cedar Creek watershed. The first recorded discharge through the Cedar Creek Reservoir spillway (USGS Gage 08062650) was in May 1966. This spillway has contributed flows to the Trinity River above Trinidad during nearly every month since October 1967, averaging more than 493,394,800 m^3 (400,000 ac-ft) per year, with approximately 50 percent of the spills having occurred during the months of March, April and May.

Flow-duration data for the Trinity River at Trinidad are presented in Table 5-10, which indicates the cumulative frequency of various mean daily discharge rates at the gaging station by indicating the percentage of time that a given flow rate has been equaled or exceeded during the period of record. Flow-duration data for the Trinity River at Trinidad indicate the median daily discharge (the flow equaled or exceeded 50 percent of the time) is approximately 28.0 m^3/sec (990 cfs), compared with the mean daily discharge of about 102.2 m^3/sec (3,610 cfs) (TNRIS, 1981). The median discharge is of interest inasmuch as TDWR water quality standards for chlorides, sulfates and total dissolved solids apply only when the median discharge for the sampling period is greater than or equal to 50 percent of the median discharge for the period of record (TDWR, 1981a).

Low flow frequency data for the Trinity River at Trinidad are presented in Table 5-11. These data were developed from records of lowest mean daily discharges at the gage for a

TABLE 5-9
RECORDED DISCHARGES IN ACRE-FEET
TRINITY RIVER AT TRINIDAD, TEXAS
(USGS GAGE 08065700)

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1964	-	-	-	-	-	-	-	-	-	247600	301600	434000	-
1965	159500	533300	244000	77510	556300	261000	36790	29460	46590	32500	44880	36120	2057950
1966	29650	132600	67560	415200	1831000	429200	251500	43980	60040	68550	24000	28260	3381540
1967	25540	23540	33360	68100	77990	223400	80480	24240	59020	132500	172900	129700	1050770
1968	331100	220200	674500	685600	786300	370200	151500	79960	36270	34610	41570	57050	3468860
1969	30090	251400	667300	410200	1423000	485900	90640	38900	43760	56470	47290	80790	3625740
1970	124500	235700	1022000	339500	482900	180400	35180	40150	88900	217000	41670	45390	2853290
1971	33460	34740	75880	55010	42630	37650	44820	72870	33760	526200	196000	1310000	2463020
1972	752800	57470	37400	50620	65030	31300	24210	27070	26660	59900	74360	38130	1744950
1973	116800	179300	461700	667200	513800	941500	189100	123500	120500	700200	438900	237500	4690000
1974	319900	90210	66950	123200	320100	206800	32200	62150	199100	143800	1200000	691000	3455410
1975	283800	904100	378900	626100	495400	549000	177800	79440	30410	25630	27500	35070	3613150
1976	26370	27810	50710	54300	233500	199300	128100	33840	127900	94520	59590	162900	1198840
1977	94020	371100	378000	978300	251000	153600	35850	49890	37240	30240	35500	29100	2443840
1978	33510	81260	126100	47490	98590	41720	26190	35710	32760	29510	46350	34710	633900
MAX	752800	904100	1022000	978300	1831000	941500	251500	123500	199100	700200	1200000	1310000	4690800
MIN	25540	23540	33360	47490	42630	31300	24210	24240	26660	25630	24000	28260	633900
MEAN	168646	224481	306026	328452	512681	293641	93169	52940	67351	159949	183474	223315	2614325
NO.	14	14	14	14	14	14	14	14	14	15	15	15	14
DISTR OF MEAN	6.5%	8.6%	11.7%	12.6%	19.6%	11.2%	3.6%	2.0%	7.6%	6.1%	7.0%	8.5%	100%

Source: TNRIS, 1981.

TABLE 5-10
ANNUAL FLOW-DURATION DATA
TRINITY RIVER AT TRINIDAD

Discharge[a] (cfs)	Percentage of Time Discharge is Equaled or Exceeded	Discharge[a] (cfs)	Percentage of Time Discharge is Equaled or Exceeded
300	100.0	2,600	32.3
320	99.9	2,800	31.2
340	99.3	3,000	29.9
360	98.2	3,200	29.2
380	96.7	3,400	28.2
400	94.5	3,600	27.4
450	85.6	3,800	26.8
500	78.3	4,000	26.2
550	72.3	4,500	24.4
600	67.3	5,000	23.1
650	63.4	5,500	21.5
700	60.2	6,000	20.1
750	58.2	6,500	18.6
800	55.9	7,000	17.0
850	54.2	7,500	15.0
900	52.5	8,000	13.6
950	51.0	8,500	12.4
1,000	49.7	9,000	11.4
1,200	45.4	9,500	10.3
1,400	42.0	10,000	9.4
1,600	39.8	20,000	2.9
1,800	37.9	30,000	1.3
2,000	36.5	40,000	0.5
2,200	35.1	50,000	0.3
2,400	33.7		

a. For metric unit equivalents, please refer to metric conversion table in the Glossary.

Period of Record: October 1964-September 1978.

Source: TNRIS, 1981.

TABLE 5-11
7-DAY LOW FLOW FREQUENCY DATA
TRINITY RIVER AT TRINIDAD

Recurrence Interval (years)	Non-Exceedance Probability (percent)	7-Day Minimum Average Flow (cfs)[a]
2	50	398[b]
5	20	355
10	10	335
20	5	321
50	2	305
100	1	296

a. For metric unit equivalents, please refer to metric conversion table in the Glossary.

b. Example: There is a 50-percent chance that streamflow at the Trinidad gage will not exceed 398 cfs for a period of at least 7 consecutive days in any one year.

Source: USGS, 1980b.

duration of seven consecutive days, as determined from USGS measurements for the years 1965-1980 (USGS, 1980b). The 2-year, 7-day low flow value is of regulatory significance because the TDWR's criteria for dissolved oxygen and temperature apply only when the mean daily discharge equals or exceeds the 2-year, 7-day minimum average flow (TDWR, 1981b).

Cedar Creek and Cedar Creek Reservoir. Cedar Creek Reservoir is impounded by the Joe B. Hogsett Dam, located on Cedar Creek about 6.4 km (4 mi) upstream of the Malakoff EGS. Tarrant County Water Control and Improvement District No. 1 is authorized under State Permit No. 1909 to use 215,860,225 m^3 (175,000 ac-ft) per year of the water stored in the reservoir for municipal purposes. The permitted impounding capacity of the reservoir is 837,414,324 m^3 (678,900 ac-ft) (TDWR, 1981b), although the total conservation pool storage is listed at 837,784,370 m^3 (679,200 ac-ft) (USGS, 1980a; TWDB, 1973). Deliberate impoundment began in July 1965, and construction on the dam was completed in February 1966. The reservoir was initially filled to its permitted impounding capacity in December 1967 and has remained nearly full (above 740,092,200 m^3 (600,000 ac-ft)) most of the time since then (TNRIS, 1981).

The USGS maintained a streamflow gage (Gage 08063020) on Cedar Creek at State Highway 31 during the period November 1964 through September 1971. Streamflows at this former gage location, near the northern boundary of the project area, were reduced substantially when deliberate impoundment in Cedar Creek Reservoir began on July 2, 1965. The streamflow records and flow-duration data for the discontinued Cedar Creek gage indicate a median discharge of 0.02 m^3/sec (0.7 cfs) and a mean daily discharge of 0.14 m^3/sec (5.0 cfs) for the period that the gage was in operation after the beginning of deliberate impoundment in Cedar Creek Reservoir. These data should be generally representative of current Cedar Creek streamflow conditions in the area of the Malakoff EGS/Trinity Mine.

Local Streams. The local on-site streams within the project area of the Malakoff EGS/Trinity Mine, which are tributary to the Trinity River and Cedar Creek, include Walnut, Turkey, Prairie and Wildcat creeks and several unnamed tributaries. As gaged streamflow records for the minor local streams within the immediate area of the Malakoff EGS/Trinity Mine are not available, selection of representative gaged watersheds in the general vicinity of the project area was necessary in order to estimate their hydrologic characteristics.

Three USGS gages, located on Catfish, Kickapoo and Tehuacana creeks in Anderson, Henderson and Freestone counties, respectively, were selected for estimating streamflow characteristics of the on-site streams. These gages, listed in Table 5-12 with pertinent information on each, were selected on the basis of watershed similarities to those of the ungaged on-site streams, the absence of upstream regulation (reservoirs, diversion, return flows, etc.) and periods of record. As indicated by the data in Table 5-12, average streamflows per square mile of drainage area for the local streams are generally low, with most of the watercourses being classified as intermittent or ephemeral. One exception is an unnamed tributary of Cedar Creek in the area of the power station, which experiences a baseflow as a result of sewage effluent discharges from the City of Malakoff. Streamflows in Turkey and Prairie creeks are affected by four SCS floodwater retarding structures.

5.6.1.5 Flood Hydrology

Power Station. Since no streamflow gages or high-water marks with sufficient flow information exist for the streams within the immediate area of the power station site, a flood frequency analysis based on historical streamflow records or the reproduction of historical floods was not possible. Without these data, a synthetic rainfall-runoff approach was necessary for the development of flood hydrology data. The SCS's TR-20 "Computer Program for Project Formulation - Hydrology" (SCS, 1965) was chosen to simulate rainfall-runoff relationships for the local streams. Models of this type use a parametric approach that attempts to express all factors influencing runoff in a deterministic form to estimate runoff for various rainfall events using a series of mathematical calculations. The SCS model uses a systematic approach based on soil types, land use, elevation differences and rainfall depths to derive quantitative rainfall-runoff relationships for small watersheds.

For purposes of developing rainfall-runoff data for the Malakoff EGS, the site was subdivided into 18 separate sub-watersheds, which are tributary to Cedar and Walnut creeks, as shown in Fig. 5-7. The TR-20 model was used to simulate the runoff response of these on-site sub-watersheds for rainfall events of 6- and 24-hour duration, with recurrence intervals ranging from 1 to 100 years. The Walnut Creek watershed, which includes a portion of the power station area, was modeled in a similar manner. Available watershed data, including topographic maps, the SCS soil survey of Henderson County, and land use patterns as determined from aerial photography, provided input to the runoff

TABLE 5-12

STREAMFLOW RECORDS FOR SELECTED USGS GAGES

Gage Name	Approximate Distance and Direction from Project Area	USGS Station Number	Period of Record	Drainage Area (mi^2)[a]	Mean Discharge		Median Discharge[b]		Discharge Equaled or Exceeded 90 Percent of the Time	
					(cfs)	(csm)	(cfs)	(csm)	(cfs)	(csm)
Catfish Creek near Tennessee Colony (Anderson County)	11 mi southeast	08064800	1962-1979	207	104	0.50	54.1	0.26	7.24	0.035
Kickapoo Creek near Brownsboro (Henderson County)	24 mi northeast	08031200	1962-1979	232	141	0.61	33.3	0.14	0.27	0.001
Tehuacana Creek near Streetman (Freestone County)	18 mi southeast	08064700	1968-1979	142	77.1	0.54	1.6	0.01	0.13	0.001

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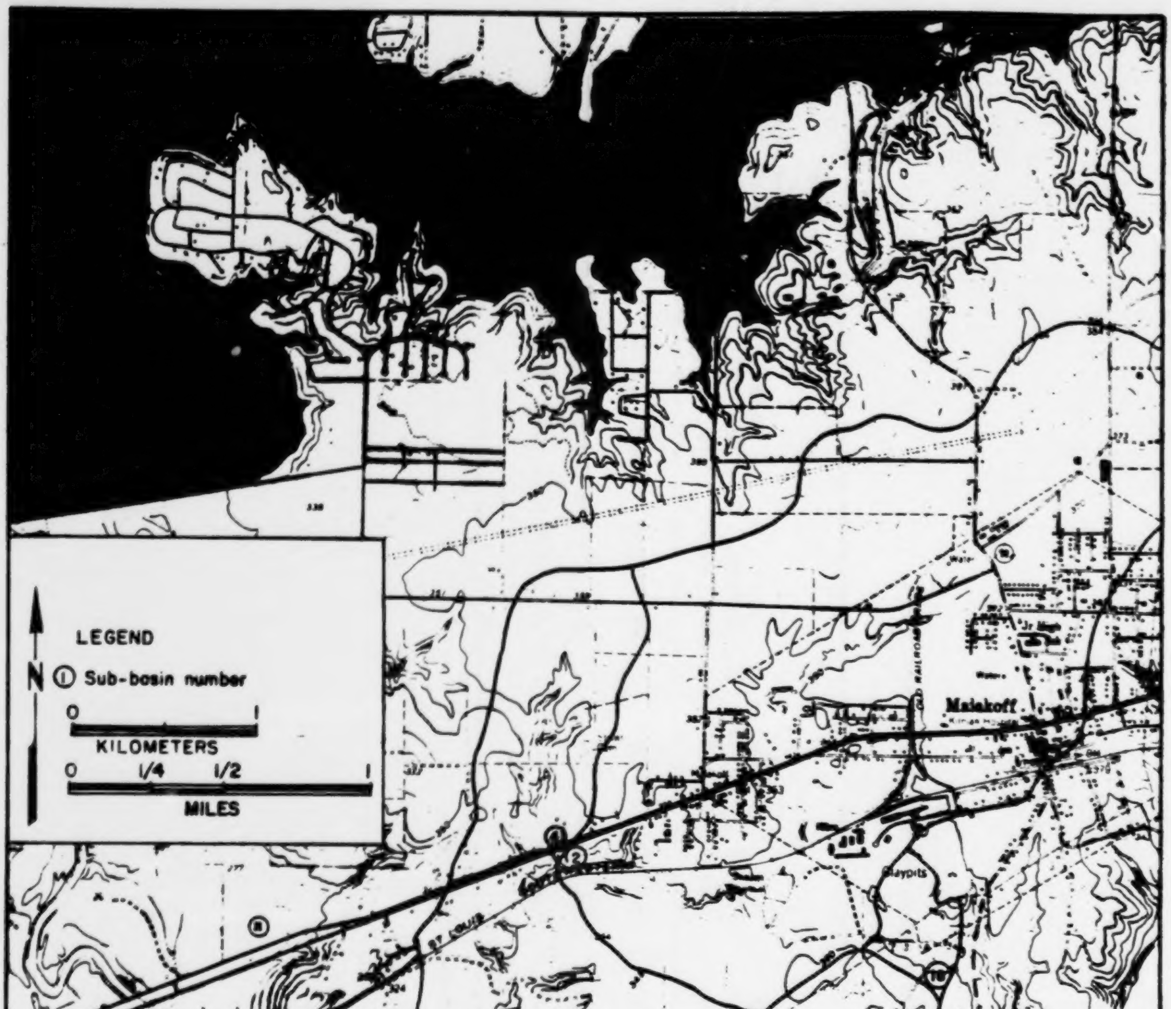
a. For metric unit equivalents, please refer to metric conversion table in the Glossary.

b. Discharge equaled or exceeded 50 percent of the time.

Source: TNRIS, 1981; USGS, 1980a.


LEGEND
① Sub-basin number
0 1
KILOMETERS
0 1/4 1/2 1
MILES
N
Malakoff
Claypits
ST LOUIS

Source: EH&A, 1982

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-7

ONSITE WATERSHEDS
MALAKOFF EGS

modeling effort. The SCS Type II rainfall distribution was used in conjunction with storm rainfall depths taken from the U. S. Weather Bureau's Technical Paper No. 40 (Hershfield, 1961). The results of the TR-20 runoff modeling for the Malakoff EGS provide data on peak runoff rates and total runoff volumes for the wide range of storms simulated at various locations in the plant site area. Table 5-13 presents representative results of the runoff modeling at several locations in the vicinity of the plant site. Documentation of these studies, including discussions of methodology and formulation of input data and detailed summaries of the results, is included in the report, "Surface-Water Hydrology of the Malakoff Electric Generating Station" (EH&A, 1982).

Cedar Creek flood discharges at the site of the Malakoff EGS were not modeled due to the varying effects on flows and flood stages resulting from the operation of Joe B. Hogsett Dam (Cedar Creek Reservoir) and backwater effects from the Trinity River. However, flood hazard boundary maps and flood insurance rate maps showing the designated 100-year flood plain of Cedar Creek in the project area are available from FEMA in connection with the National Flood Insurance Program (FIA, 1977; 1979). The Cedar Creek flood plain delineation was shown previously in Fig. 5-5.

Mine. Rainfall-runoff data for streams in the Trinity Mine area were also developed using the TR-20 model. For purposes of these simulations, the mine area was divided into four primary study areas, including the Turkey Creek watershed, the Wildcat Creek watershed, the area within Henderson County Levee No. 3 (denoted "interior levee watershed") and several unnamed watersheds in the southern portion of the mine area which drain directly to the Trinity River (denoted "southern watersheds"). These watersheds were subdivided into a total of 34 individual sub-watersheds, as shown in Fig. 5-8. The TR-20 model was used to simulate the runoff response of these sub-watersheds for storm events of 24-hour duration and frequencies of 2, 5, 10, 50 and 100 years. The modeling included flood routings through the four SCS floodwater retarding reservoirs located within the watersheds to reflect their flood peak attenuation effects. Representative results from the hydrologic modeling for the Trinity Mine are presented in Table 5-14. Documentation of these studies and detailed results are included in a report entitled, "Surface Water Input to the Trinity Mine EIS" (NACCO, 1982).

5.6.1.6 Water Quality

Power Station. Although the Malakoff EGS is located in the Trinity River Basin, and the Trinity River will be the ultimate receiving stream for any power plant discharges

TABLE 5-13

SUMMARY OF PEAK FLOW AND RUNOFF VOLUMES AT REPRESENTATIVE CHANNEL CROSS SECTIONS FOR STUDY AREA WATERSHEDS

MALAKOFF EGS

Cross Section Location	Drainage Area (mi^2)	Storm	Rainfall (inches)	Peak Flow (cfs)	Peak Flow (csm)	Runoff Volume (ac-ft)	Runoff Volume ($ac\text{-}ft/mi^2$)
Sub-Basin 1 Outlet	0.387	1-year, 6-hour	2.6	100	258	16.3	42.1
		2-year, 6-hour	3.2	162	420	24.6	63.6
		5-year, 6-hour	4.2	281	728	40.1	103.6
		10-year, 6-hour	4.9	373	965	51.8	133.9
		25-year, 6-hour	5.9	512	1,322	69.3	179.1
		50-year, 6-hour	6.6	612	1,580	81.9	211.6
		100-year, 6-hour	7.4	728	1,882	96.7	249.9
		1-year, 24-hour	3.4	414	1,071	27.5	71.1
		2-year, 24-hour	4.3	634	1,639	41.7	107.8
		5-year, 24-hour	5.8	1,039	2,685	67.5	174.4
		10-year, 24-hour	6.9	1,355	3,500	87.4	225.8
		25-year, 24-hour	8.0	1,680	4,340	107.9	278.8
		50-year, 24-hour	9.1	2,012	5,199	128.8	332.8
		100-year, 24-hour	10.2	2,349	6,070	150.0	387.6
Sub-Basin 3 Outlet	4.369	1-year, 6-hour	2.6	524	120	169.9	38.9
		2-year, 6-hour	3.2	810	185	260.2	59.6
		5-year, 6-hour	4.2	1,352	310	429.8	98.4
		10-year, 6-hour	4.9	1,764	404	558.4	127.8
		25-year, 6-hour	5.9	2,384	546	751.8	172.1
		50-year, 6-hour	6.6	2,833	648	892.2	204.2
		100-year, 6-hour	7.4	3,358	769	1,056.5	241.8
		1-year, 24-hour	3.4	1,292	296	292.4	66.9
		2-year, 24-hour	4.3	1,952	447	447.7	102.5
		5-year, 24-hour	5.8	3,147	720	732.0	167.5
		10-year, 24-hour	6.9	4,070	932	953.4	218.2
		25-year, 24-hour	8.0	5,019	1,149	1,181.8	270.5
		50-year, 24-hour	9.1	5,987	1,370	1,415.3	323.9
		100-year, 24-hour	10.2	6,968	1,595	1,652.7	378.3
Sub-Basin 8 Outlet	0.725	1-year, 6-hour	2.6	83.1	115	18.0	24.8
		2-year, 6-hour	3.2	141	195	29.4	40.6
		5-year, 6-hour	4.2	258	356	51.8	71.4
		10-year, 6-hour	4.9	351	484	69.3	95.6
		25-year, 6-hour	5.9	493	680	96.1	132.6
		50-year, 6-hour	6.6	598	825	115.8	159.7
		100-year, 6-hour	7.4	722	996	139.1	191.9

TABLE 5-13 (Cont'd)

Cross Section Location	Drainage Area (mi^2)	Storm	Rainfall (inches)	Peak Flow (cfs)	Peak Flow (csm)	Runoff Volume (ac-ft)	Runoff Volume (ac-ft/mi^2)
		1-year, 24-hour	3.4	291	401	40.7	56.1
		2-year, 24-hour	4.3	466	643	64.6	89.1
		5-year, 24-hour	5.8	796	1,098	109.1	150.5
		10-year, 24-hour	6.9	1,058	1,459	144.4	199.2
		25-year, 24-hour	8.0	1,330	1,835	181.0	249.7
		50-year, 24-hour	9.1	1,611	2,223	218.7	301.7
		100-year, 24-hour	10.2	1,899	2,619	257.2	354.8
Walnut Creek at State Highway 90	34.04	1-year, 6-hour	2.3	835	24.5	574.8	16.9
		2-year, 6-hour	2.9	1,629	47.9	1,067.9	31.4
		5-year, 6-hour	3.8	3,142	92.3	1,982.5	58.2
		10-year, 6-hour	4.4	4,319	126.9	2,678.8	78.7
		25-year, 6-hour	5.3	6,281	184.5	3,819.1	112.2
		50-year, 6-hour	5.9	7,689	225.9	4,629.4	136.0
		100-year, 6-hour	6.7	9,666	284.0	5,758.6	169.2
		1-year, 24-hour	3.2	1,701	50.0	1,330.5	39.1
		2-year, 24-hour	4.0	2,950	86.7	2,175.2	63.9
		5-year, 24-hour	5.5	5,806	170.6	4,031.3	118.4
		10-year, 24-hour	6.5	7,953	233.7	5,403.1	158.7
		25-year, 24-hour	7.5	10,229	300.5	6,849.5	201.2
		50-year, 24-hour	8.6	12,839	377.2	8,505.3	249.9
		100-year, 24-hour	9.6	15,283	449.0	10,055.9	295.4
Walnut Creek Upstream of Turkey Creek	38.58	1-year, 6-hour	2.3	816	21.2	695.4	18.0
		2-year, 6-hour	2.9	1,594	41.3	1,272.3	33.0
		5-year, 6-hour	3.8	3,072	79.6	2,333.1	60.5
		10-year, 6-hour	4.4	4,216	109.3	3,136.9	81.3
		25-year, 6-hour	5.3	6,114	158.5	4,448.8	115.3
		50-year, 6-hour	5.9	7,475	193.8	5,378.8	139.4
		100-year, 6-hour	6.7	9,386	243.3	6,672.5	173.0
		1-year, 24-hour	3.2	1,722	44.6	1,470.7	38.1
		2-year, 24-hour	4.0	2,949	76.4	2,395.3	62.1
		5-year, 24-hour	5.5	5,735	148.7	4,424.4	114.7
		10-year, 24-hour	6.5	7,825	202.8	5,923.3	153.5
		25-year, 24-hour	7.5	10,036	260.1	7,503.3	194.5
		50-year, 24-hour	8.6	12,571	325.8	9,311.8	241.4
		100-year, 24-hour	9.6	14,942	387.3	11,005.4	285.3
Walnut Creek Downstream of Turkey Creek	65.96	1-year, 6-hour	2.3	885	13.4	831.3	12.6
		2-year, 6-hour	2.9	1,616	24.5	1,500.4	22.7
		5-year, 6-hour	3.8	3,106	47.1	2,717.9	41.2
		10-year, 6-hour	4.4	4,259	64.6	3,634.6	55.1
		25-year, 6-hour	5.3	6,169	93.5	5,123.9	77.7
		50-year, 6-hour	5.9	7,538	114.3	6,177.0	93.6
		100-year, 6-hour	6.7	9,459	143.4	7,636.6	115.8

TABLE 5-13 (Concluded)

Cross Section Location	Drainage Area (mi^2)	Storm	Rainfall (inches)	Peak Flow (cfs)	Peak Flow (csm)	Runoff Volume (ac-ft)	Runoff Volume (ac-ft/mi^2)
		1-year, 24-hour	3.2	1,831	27.8	1,724.4	26.1
		2-year, 24-hour	4.0	3,104	47.1	2,782.9	42.2
		5-year, 24-hour	5.5	5,980	90.7	5,089.7	77.2
		10-year, 24-hour	6.5	8,129	123.2	6,785.8	102.9
		25-year, 24-hour	7.5	10,400	157.7	8,568.8	129.9
		50-year, 24-hour	8.6	12,999	197.1	10,665.3	161.7
		100-year, 24-hour	9.6	15,744	238.7	12,733.2	193.0

TABLE 5-14
SUMMARY OF PEAK FLOW AND RUNOFF VOLUMES OF REPRESENTATIVE CROSS SECTIONS FOR STUDY AREA WATERSHEDS
PREMINING CONDITIONS
TRINITY MINE

Watershed	Cross Section	Drainage Area (mi^2)	Storm	Rainfall (in.)	Peak Flow (cfs)	Peak Flow (csm)	Runoff Volume (ac-ft)	Runoff Volume (ac-ft/mi^2)
Wildcat Creek	202	10.48	2-yr, 24-hr	4.1	711	67.9	907.8	86.6
			5-yr, 24-hr	5.6	1,268	121.0	1,559.2	148.8
			10-yr, 24-hr	6.6	1,666	159.1	2,025.7	193.3
			50-yr, 24-hr	8.7	2,540	242.4	3,057.3	291.7
			100-yr, 24-hr	9.8	3,010	287.2	3,616.7	345.1
	205	31.40	2-yr, 24-hr	4.1	2,952	94.0	2,315.9	73.7
			5-yr, 24-hr	5.6	5,638	179.6	4,131.1	131.6
			10-yr, 24-hr	6.6	7,613	242.5	5,454.2	173.7
			50-yr, 24-hr	8.7	12,044	383.6	8,419.2	268.1
			100-yr, 24-hr	9.8	14,464	460.6	10,041.8	319.8
	206	32.38	2-yr, 24-hr	4.1	2,752	85.0	2,397.8	74.0
			5-yr, 24-hr	5.6	5,185	160.1	4,272.1	131.9
			10-yr, 24-hr	6.6	6,985	215.7	5,637.3	174.1
			50-yr, 24-hr	8.7	11,025	340.5	8,697.2	268.6
			100-yr, 24-hr	9.8	13,233	408.7	10,317.9	320.3
Southern	301	1.26	2-yr, 24-hr	4.3	545	433.1	124.3	98.7
			5-yr, 24-hr	5.8	923	732.9	205.6	163.2
			10-yr, 24-hr	6.9	1,215	964.9	268.8	213.3
			50-yr, 24-hr	9.1	1,819	1,443.7	401.2	318.4
			100-yr, 24-hr	10.2	2,125	1,686.8	469.7	372.8
	303	0.27	2-yr, 24-hr	4.3	147	544.0	17.3	64.0
			5-yr, 24-hr	5.8	286	1,059.2	31.5	116.8
			10-yr, 24-hr	6.9	399	1,477.7	43.2	160.0
			50-yr, 24-hr	9.1	641	2,374.5	68.7	254.4
			100-yr, 24-hr	10.2	767	2,841.4	82.1	304.0
	306	8.18	2-yr, 24-hr	4.3	2,112	258.2	807.1	98.7
			5-yr, 24-hr	5.8	3,565	435.8	1,335.0	163.2
			10-yr, 24-hr	6.9	4,690	573.3	1,745.0	213.3
			50-yr, 24-hr	9.1	7,015	857.6	2,604.5	318.4
			100-yr, 24-hr	10.2	8,198	1,002.2	3,045.1	372.3

TABLE 5-14 (Concluded)

Watershed	Cross Section	Drainage Area (mi^2)	Storm	Rainfall (in.)	Peak Flow (cfs)	Peak Flow (csm)	Runoff Volume (ac-ft)	Runoff Volume (ac-ft/mi^2)
Turkey Creek	SCS Structure #2 (inflow)	19.80	2-yr, 24-hr	4.1	3,891	196.5	1,649.6	83.3
			5-yr, 24-hr	5.6	6,970	352.0	2,861.6	144.5
			10-yr, 24-hr	6.6	9,175	463.4	3,733.5	188.6
			50-yr, 24-hr	8.7	14,619	708.0	5,665.7	286.1
			100-yr, 24-hr	9.8	16,576	837.2	6,714.6	339.1
	SCS Structure #2 (outflow)	19.80	2-yr, 24-hr	4.1	36	1.8	1,649.6	83.3
			5-yr, 24-hr	5.6	53	2.7	2,861.6	144.5
			10-yr, 24-hr	6.6	62	3.1	3,733.5	188.6
			50-yr, 24-hr	8.7	80	4.0	5,665.7	286.1
			100-yr, 24-hr	9.8	88	4.5	6,714.6	339.1
	a	25.86	2-yr, 24-hr	4.1	1,067	41.3	2,174.1	84.1
			5-yr, 24-hr	5.6	1,892	73.2	3,760.9	145.4
			10-yr, 24-hr	6.6	2,473	95.6	4,901.0	189.5
			50-yr, 24-hr	8.7	3,743	144.7	7,427.1	287.2
			100-yr, 24-hr	9.8	4,422	171.0	8,797.7	340.2
	108	27.38	2-yr, 24-hr	4.1	803	29.3	2,278.8	83.2
			5-yr, 24-hr	5.6	1,410	51.5	3,950.1	144.3
			10-yr, 24-hr	6.6	1,841	67.2	5,152.4	188.2
			50-yr, 24-hr	8.7	2,783	101.6	7,818.4	285.5
			100-yr, 24-hr	9.8	3,288	120.1	9,266.0	338.4
Interior Levee	406	7.87	2-yr, 24-yr	4.1	918	116.6	650.6	82.7
			5-yr, 24-hr	5.6	1,674	212.7	1,129.1	143.5
			10-yr, 24-hr	6.6	2,224	282.6	1,473.3	187.2
			50-yr, 24-hr	8.7	3,446	437.9	2,237.2	284.3
			100-yr, 24-hr	9.8	4,109	522.1	2,652.7	337.1
	416	21.27	2-yr, 24-hr	4.1	1,444	67.9	2,064.6	97.1
			5-yr, 24-hr	5.6	2,408	113.3	3,448.6	162.1
			10-yr, 24-hr	6.6	3,086	145.1	4,424.2	208.0
			50-yr, 24-hr	8.7	4,560	214.4	6,568.2	308.8
			100-yr, 24-hr	9.8	5,350	251.5	7,713.9	362.7
	422	25.58	2-yr, 24-hr	4.1	1,749	68.4	2,523.9	98.7
			5-yr, 24-hr	5.6	2,905	113.6	4,188.3	163.7
			10-yr, 24-hr	6.6	3,718	145.3	5,375.2	210.1
			50-yr, 24-hr	8.7	5,482	214.3	7,953.7	310.9
			100-yr, 24-hr	9.8	6,475	251.2	9,345.2	365.3

(either directly or via Cedar and/or Walnut creeks), makeup water for the power station will be supplied from the Neches River and Lake Palestine, located in the adjacent Neches River Basin. Since the Malakoff EGS will involve both a trans-basin diversion for makeup water supply and an in-basin discharge, this section presents baseline water-quality data for portions of both the Neches and Trinity river basins in the vicinity of the project.

Makeup Water. The makeup water supply for the Malakoff EGS will be obtained by HL&P from the Upper Neches River Municipal Water Authority under a contractual agreement. The UNRMWA owns and operates Lake Palestine on the Neches River in Anderson, Cherokee, Henderson and Smith counties. Lake Palestine has a normal operating capacity of 507,999,286 m^3 (411,840 ac-ft) and an estimated firm yield of 262,363,685 m^3 (212,700 ac-ft) per year (TWDB, 1977). The UNRMWA also maintains a small channel dam on the Neches River approximately 40 river kilometers (25 river miles) downstream of Lake Palestine. The channel dam forms a pool from which releases from Lake Palestine are pumped to the City of Palestine. The proposed makeup water supply for the Malakoff EGS consists of run-of-the-river Neches River streamflows between Lake Palestine and the existing channel dam, supplemented when necessary by releases from Lake Palestine so as to provide for continuous operation. HL&P's pump station for the Malakoff EGS will be located on the pool formed by the UNRMWA's channel dam on the Neches River.

The USGS began the collection of surface water-quality data in the Neches River Basin in 1939. Since that time, the USGS network has been expanded to include a number of daily water-quality monitoring stations on principal streams and supplementary partial-record stations at additional sites. To supplement the data being obtained by the USGS, a cooperative Statewide Monitoring Network by the USGS and Texas Water Commission was initiated in September 1961 (TWDB, 1965). The program, now administered by the TDWR, provides data at sites not monitored by the USGS and aids in the delineation of water-quality problem areas.

Long-term records indicate that surface waters in the Neches River Basin are generally of excellent quality. Waters in the upper half of the basin are classified as soft (30 to 60 mg/L as $CaCO_3$). Levels of dissolved constituents in the upper basin are generally low, with total dissolved solids concentrations seldom exceeding 250 mg/L, except in specific problem areas such as the Striker Creek watershed, which has experienced significant pollution from oilfield brine. Most surface waters in the basin are suitable, with a minimum of treatment, for domestic, industrial and irrigation uses (TWDB, 1965).

Recent water-quality data for the Neches River are available from the USGS and TDWR in connection with the ongoing monitoring programs. TDWR Monitoring Station 0605.0100, a component of the Statewide Monitoring Network, is located on Lake Palestine at mid-lake. Quarterly sampling results for the station have been reported since 1972. Table 5-15 presents water-quality data for several parameters analyzed during water year 1978 (TNRIS, 1981). Limited water-quality data for Lake Palestine (two samples per year) are also available from the USGS. Neches River water-quality data are collected by the TDWR at the U. S. Highway 175 bridge east of Frankston (TDWR Station 0604.0600). This station is located between Lake Palestine and the Neches River channel dam and should provide baseline data indicative of the proposed source of supply for the Malakoff EGS. Water-quality data for this station are available for the period of record 1972-1978, primarily at monthly or quarterly intervals through 1976 and annually in 1977 and 1978. Representative water-quality data for the Neches River at U. S. Highway 175 are included in Table 5-15.

HL&P performed water-quality simulations of the Lake Palestine/Neches River channel dam system in 1980 to project ranges of chemical constituent concentrations and pH levels of the makeup water sources for the Malakoff EGS. These studies were conducted to support analysis and design of in-plant water systems and to provide a general water-quality overview for the makeup water source. Water-quality simulations were performed for the 20-year period 1950-1969 under two scenarios of watershed development corresponding to the estimated project life (years 1990 through 2027). Input data for the years 1990 and 2027 reflect anticipated hydrologic conditions, based on projected watershed management practices, upstream water usage, upstream reservoirs, and sediment accumulation in Lake Palestine. HL&P performed a verification run to compare simulated water-quality results with historical values recorded by the USGS. In general, the ranges defined by the model results compared favorably with historical data. The water quality simulations are documented in a report entitled, "Water Chemistry Study of the Site X Makeup Water Supply" (HL&P, 1980a).

Makeup Water Pipeline. As the makeup water supply for the Malakoff EGS will involve a trans-basin diversion of surface water from the Neches River Basin to the Trinity River Basin, portions of both basins will be affected by the makeup water pipeline. The pipeline corridor connecting the proposed pump station on the Neches River channel impoundment with the Malakoff EGS will cross a number of minor streams. The streams to be crossed by the pipeline within the Neches River Basin, listed in order from east to west, include

TABLE 5-15

TDWR WATER QUALITY DATA

NECHES RIVER AND LAKE PALESTINE

Parameter	Lake Palestine (mid-lake) (TWDR Gage 0605.0100)[a]			Neches River at U.S. Highway 175 East of Frankston (TDWR Gage 0604.0600)[b]		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Specific Conductance (micromhos/cm)	178	160	210	183	125	640
pH (standard units)	7.2	6.7	8.0	7.1	6.3	8.0
Dissolved Oxygen (mg/L)	8.5	5.9	10.5	8.0	5.4	11.0
Total Dissolved Solids[c] (mg/L)	110	97	121	---	---	---
Chloride (mg/L)	24	21	27	20	9	35
Sulfate (mg/L)	22	8	30	19	9	25

a. Data reported for water year 1978.

b. Data reported for period of record 1972-1978.

c. TDS data not reported by TDWR; values shown are from USGS records, 1978-1979.

Source: TNRIS, 1981; USGS, 1979, 1980a.

White Oak Creek, Cooper Creek, Walnut Creek, Little Brushy Creek and several unnamed tributaries. Within the Trinity River Basin, Wolf Creek, Catfish Creek, Mine Creek, Mill Creek, Turkey Creek, Walnut Creek and several unnamed tributaries will be crossed by the proposed makeup water pipeline. In most instances, stream crossings by the pipeline will occur within the upper reaches of the streams. Although water quality data for the other local streams to be affected by the pipeline are not readily available, it is likely that the water quality characteristics of these streams are similar to those of Walnut and Turkey creeks, which are presented later in this section in conjunction with site-specific water quality monitoring for the power plant and mine.

Receiving Streams. The Trinity River will serve as the ultimate receiving stream for discharges from the Malakoff EGS, via Cedar and/or Walnut creeks. This section covers applicable water-quality standards, historical water-quality data, and water-quality monitoring for the Trinity River, Cedar Creek and Walnut Creek in the vicinity of the proposed Malakoff EGS.

State water-quality standards for the Trinity River Basin were promulgated in 1973 pursuant to the FWPCA. The basin is divided into 16 stream segments and 18 reservoir segments. The segments in the vicinity of the Malakoff EGS include Segment 0804 (the Trinity River from SH 34 near Rosser to the headwaters of Lake Livingston) and Segment 0818 (Cedar Creek Reservoir). TDWR water-quality standards for these segments are listed in Table 5-16. Segment 0804 of the Trinity River is deemed suitable only for noncontact recreation and fish and wildlife propagation, while Cedar Creek Reservoir is considered suitable for these uses, as well as for contact recreation and domestic water supply (TDWR, 1981a). Numerical water-quality criteria have not been established for Cedar and Walnut creeks, which are, therefore, subject to the TDWR's general criteria for all surface waters of the state.

The water quality of Trinity River Segment 0804, extending from the SH 34 bridge near Rosser in Kaufman County to the headwaters of Lake Livingston in Houston County, is heavily influenced by discharges from wastewater treatment plants in the Dallas-Fort Worth metropolitan area. Return flows from sewage treatment facilities comprise a major portion of the total dry-weather streamflow in the immediate Dallas-Fort Worth area (Segment 0805). This situation also occurs to a substantial, though lesser, degree along Segment 0804. These effluent-dominated reaches of the Trinity River are characterized by depressed dissolved oxygen levels and high biochemical oxygen demand

TABLE 5-16
TDWR WATER QUALITY STANDARDS
TRINITY RIVER BASIN - SEGMENTS 0804 AND 0818

Parameter	TDWR Standards for	
	Segment 0804[a]	Segment 0818[b]
Chloride (mg/L)	Not to exceed 150	Not to exceed 50
Sulfate (mg/L)	Not to exceed 150	Not to exceed 50
Total Dissolved Solids (mg/L)	Not to exceed 600	Not to exceed 200
Dissolved Oxygen (mg/L)	Not less than 5.0	Not less than 5.0
pH (@ 25°C)	6.5 - 8.5	6.0 - 8.5
Fecal Coliform (#/100 mL)	Geometric mean not to exceed 2,000	Geometric mean not to exceed 200
Temperature (°F)	Not to exceed 93	Not to exceed 93

a. Trinity River from SH 34 near Rosser to the headwaters of Lake Livingston.

b. Cedar Creek Reservoir.

Source: TDWR, 1981b.

(BOD), as well as ammonia, volatile suspended solids, phosphate and fecal coliform concentrations (Trinity River Authority, 1974). Despite the generally poor water quality of these segments, some improvement has occurred in recent years, primarily as a result of consolidation, modification and replacement of municipal treatment facilities discharging directly or indirectly into the Trinity River (TWQB, 1975).

The upper Trinity River has been monitored intensively by a number of agencies, including the TDWR, Texas Department of Health (TDH), Trinity River Authority (TRA) and the USGS. In addition, a number of special surveys have been conducted (TWQB, 1975). With regard to Segment 0804, the USGS monitors streamflow at SH 34 southwest of Rosser (the upstream limit of Segment 0804) and at SH 31 east of Trinidad, approximately 4.8 km (3 mi) west of the Malakoff EGS site. These locations are also maintained by the TDWR as water-quality monitoring stations in connection with its Statewide Monitoring Network. Comprehensive water-quality monitoring is conducted at approximately monthly intervals at these stations, with continuous monitoring of the primary physical parameters conducted at the Rosser station (USGS, 1980a; TNRIS, 1981).

Selected water-quality data for the Trinity River at the Rosser and Trinidad monitoring stations are presented in Table 5-17. This table includes mean, minimum and maximum values for several parameters, including those for which the TDWR has set specific numerical criteria, during water year 1979. If available, minimum and maximum values for the period of record are also listed. Occasional violations of TDWR stream standards for Trinity River Segment 0804 are reported, although generally with less frequency than in previous years.

Cedar Creek Reservoir, located on Cedar Creek approximately 6.4 km (4 mi) upstream of the Malakoff EGS site, is monitored by the TDWR in connection with its Statewide Monitoring Network. Samples are taken periodically from mid-lake (TDWR Monitoring Station 0818.0100) and from the Kings Creek arm at SH 274 (Station 0818.0200). However, very little water-quality data are available for Cedar Creek downstream of Cedar Creek Reservoir in the immediate project area. Streamflows in this reach are the result of runoff from the intervening drainage area downstream of the dam and low flow releases from the reservoir. Flood inflows to Cedar Creek Reservoir are discharged directly to the Trinity River through a spillway located several miles upstream of the dam and, hence, do not affect the reach of Cedar Creek adjacent to the Malakoff EGS (TWDB, 1974).

TABLE 5-17
TRINITY RIVER WATER QUALITY DATA
WATER YEAR 1979

Parameter	Trinity River near Rosser USGS Gage 08062500 (TDWR Gage 0805.0100)			Trinity River at Trinidad USGS Gage 08062700 (TDWR Gage 0804.0600)		
	Mean[a]	Minimum	Maximum	Mean[a]	Minimum	Maximum
Specific Conductance (micromhos/cm)	501	202 (200)[b]	1,030 (2,990)	457	250 (250)	920 (1,000)
pH (standard units)	-	7.0 (7.0)	7.8 (7.8)	-	7.4	7.8
Temperature (°F)	68	39 (34)	89 (97)	66[c]	38 (34)	90 (93)
Dissolved Oxygen (mg/L)	4.3	0.0 (0.0)	8.7 (10.7)	5.4[c]	2.8	9.6
Total Dissolved Solids (mg/L)	280	198	527	250	201	508
Chloride (mg/L)	32	14	92	29	15	97
Sulfate (mg/L)	59	35	140	53	35	130
Hardness (mg/L as $CaCO_3$)	150	120	210	140	120	220
Fecal Coliform (#/100 mL)	2,925[d]	0 (0)	11,300 (TNTC)[e]	369[c]	40	1,300

a. Annual means determined from daily or monthly mean values unless noted otherwise.

b. Numbers in parentheses denote extremes for period of record.

c. Average of 12 samples.

d. Fecal coliform reported for only four samples in water year 1979.

e. Too numerous to count.

Sources: USGS, 1980a; TNRIS, 1981.

The Texas Water Quality Board (TWQB) conducted a two-day, intensive water-quality monitoring survey of Cedar Creek Reservoir on March 13-14, 1974 (TWQB, 1976). The survey included one monitoring station on Cedar Creek downstream of the dam at SH 31, which provides the only published water-quality survey results in the immediate area of the Malakoff EGS. The intensive monitoring survey report provides a general assessment of water quality in Cedar Creek Reservoir and adjoining streams at the time of the survey and includes an inventory of point source discharges to Segment 0818. Results from the survey indicated generally good water quality throughout the reservoir. High nutrient and fecal coliform levels in localized areas (primarily the tributaries) did not materially affect the overall water quality of the reservoir. Survey results for Cedar Creek at SH 31 (downstream of the dam) indicated concentrations of dissolved constituents and a coliform level similar to the reservoir tributaries and considerably higher than for the reservoir itself.

Due to the lack of sufficient data to adequately characterize the existing water quality of Cedar Creek and its tributaries in the immediate vicinity of the Malakoff EGS, HL&P conducted a baseline water-quality monitoring program involving bimonthly sampling at two sites: Cedar Creek at the county road bridge near Cresslan Ranch, downstream of the Malakoff EGS site, and Walnut Creek at the SH 90 bridge south of Malakoff and to the east of the Malakoff EGS site. The monitoring efforts include in situ measurements of water temperature, pH, dissolved oxygen and specific conductance and laboratory analyses for a total of 68 parameters. The duration of the baseline water-quality monitoring program extended from August 1981 through June 1982, for a total of six bimonthly samples. Results of the baseline water quality monitoring program for Cedar and Walnut creeks are presented in Tables 5-18 and 5-19, respectively. The water quality of Cedar Creek at the monitoring site is affected to varying degrees by backwater from the Trinity River. As the Trinity River remained at a relatively high stage throughout much of the monitoring period, the results of the survey reflect these backwater effects to a substantial degree. The concentrations of chloride, sulfate and total dissolved solids at the Cedar Creek monitoring site remained within the TDWR's numerical standards for Trinity River Segment 0804, but exceeded the corresponding standards for Cedar Creek Reservoir (Segment 0818) in several instances. Fecal coliform concentrations at the Cedar Creek monitoring site varied over a wide range, and dissolved oxygen levels below the TDWR's minimum standard of 5.0 mg/L were noted during four of the six sampling efforts, possibly reflecting backwater effects from the effluent-dominated Trinity River. In comparison to Cedar Creek, Walnut Creek generally exhibited lower concentrations of

TABLE 5-18
CEDAR CREEK WATER QUALITY DATA
1981-1982

Parameter	Sampling Date 8-17-81	 10-14-81	 12-15-81	 2-16-82	 4-14-82	 6-14-82
Temperature (^oC)	28	22	11.5	13.5	22	25
pH, field (standard units)	7.3	7.4	7.2	7.2	7.6	7.0
pH, lab (standard units)	7.6	7.2	7.2	8.2	7.4	7.5
Specific Conductance, field (micromhos/cm)	700	200	190	610	800	288
Specific Conductance, lab (micromhos/cm)	720	280	265	790	790	275
Dissolved Oxygen	3.2	4.1	4.4	11.2	8.3	3.0
Turbidity (NTU)	24.0	224	88.0	40.0	112	14.0
Calcium	61.6	26.0	22.5	72.0	51.1	22.8
Sodium	74.0	46.0	17.0	76.0	73.1	18.5
Potassium	5.61	5.17	4.47	4.88	6.90	6.18
Bicarbonate	227	59.3	99.1	164	175	126
Carbonate	< 1	< 1	< 1	< 1	< 1	< 1
Hydroxide	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sulfate	45.0	63.0	21.0	94.0	85.0	18.0
Chloride	84.0	34.4	24.0	108	98.0	19.2
Total Dissolved Solids	332	216	190	468	468	200
Total Suspended Solids	65	159	62	35	119	12
Total Alkalinity (as CaCO3)	188	52	83	136	145	105
P-Alkalinity (as CaCO3)	< 5	< 5	< 5	< 5	< 5	< 5
Total Acidity (as CaCO3)	< 5	< 5	< 5	< 5	< 5	< 5
Total Hardness (as CaCO3)	198	92	72	227	177	77
Phosphate-Ortho	0.06	0.15	0.05	0.11	0.06	0.16
Phosphate-Total	0.09	0.28	0.05	0.12	0.08	0.19
Nitrogen-Kjeldahl (organic)	0.84	1.38	0.64	1.82	1.73	0.17
Nitrogen-Kjeldahl (total)	1.01	1.50	0.64	1.82	1.73	0.49
Ammonia	0.17	0.12	< 0.09	< 0.09	< 0.09	0.32
Nitrate	0.02	0.41	0.27	0.71	0.80	0.08
Nitrite	0.004	0.019	0.007	0.011	0.027	0.003
Fluoride	0.49	0.24	0.41	0.38	0.72	0.33
Organic Carbon, Total (TOC)	11	12	9	6	16	9
Color (color units)	50	65	< 50	< 50	< 50	< 50
Phenol	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Oil and Grease, Total	< 5	< 5	< 5	< 5	< 5	< 5
Biochemical Oxygen Demand (BOD)	16	18	8	14	15	< 1
Chemical Oxygen Demand (COD)	47	32	37	22	25	26
Coliform, Fecal (no./100 mL)	72	7,500	32	14	252	6
Total Hardness (as CaCO3)	200	62	116	199	199	102

TABLE 5-18 (Concluded)

Parameter	Sampling Date					
	8-17-81	10-14-81	12-15-81	2-16-82	4-14-82	6-14-82
Total Metals:						
Total Aluminum	1.9	12.7	1.9	0.9	1.9	0.1
Total Arsenic	< 0.005	< 0.005	0.005	< 0.005	< 0.005	0.012
Total Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Boron	0.05	0.10	< 0.02	0.05	0.05	0.10
Total Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.075
Total Chromium	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total Copper	< 0.01	0.03	< 0.01	0.01	< 0.01	< 0.01
Total Iron	1.96	4.72	1.78	1.08	1.99	0.63
Total Lead	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Total Magnesium	12.2	9.1	4.1	11.7	12.4	4.9
Total Manganese	0.60	0.17	0.12	0.21	0.48	0.27
Total Mercury (µg/L)	< 2	< 2	< 2	< 2	< 2	< 2
Total Molybedenum	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Nickel	< 0.02	< 0.02	0.06	< 0.02	< 0.02	< 0.02
Total Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.008
Total Strontium	0.18	< 0.05	0.10	0.17	0.18	0.25
Total Zinc	0.02	0.11	0.15	0.02	0.01	0.03
Dissolved Metals:						
Dissolved Aluminum	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Dissolved Arsenic	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.011
Dissolved Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dissolved Boron	0.04	0.05	< 0.02	< 0.02	0.03	0.07
Dissolved Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Chromium	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Copper	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Dissolved Iron	< 0.05	0.14	< 0.05	< 0.05	0.05	0.07
Dissolved Lead	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Magnesium	10.9	6.80	3.97	11.5	12.2	4.90
Dissolved Manganese	0.45	0.03	0.02	0.14	0.36	0.18
Dissolved Mercury (µg/L)	< 2	< 2	< 2	< 2	< 2	< 2
Dissolved Molybdenum	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dissolved Nickel	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007
Dissolved Silica	9	10	6	8	11	7
Dissolved Strontium	0.16	< 0.05	0.10	0.13	0.17	0.25
Dissolved Zinc	0.01	0.02	0.12	0.01	< 0.01	0.01

All values are reported in mg/L unless noted otherwise.

TABLE 5-19
WALNUT CREEK WATER QUALITY DATA
1981-1982

Parameter	Sampling Date					
	8-17-81	10-14-81	12-15-81	2-16-82	4-14-82	6-14-82
Temperature (^{o}C)	27	23	8.5	13	20	23
pH, field (standard units)	5.9	7.0	7.3	7.2	7.1	7.2
pH, lab (standard units)	7.5	7.3	7.1	7.6	7.2	7.5
Specific Conductance, field (micromhos/cm)	580	127	270	355	440	400
Specific Conductance, lab (micromhos/cm)	620	150	383	480	450	396
Dissolved Oxygen	4.3	6.2	11.0	10.8	8.7	6.7
Turbidity (NTU)	31.0	640	18.0	26.0	42.0	43.0
Calcium	37.1	12.0	21.7	43.4	24.7	19.4
Sodium	66.0	20.0	48.0	55.0	42.9	51.1
Potassium	8.64	5.99	7.32	6.62	6.80	8.76
Bicarbonate	141	40.3	93.0	97.6	97.1	118
Carbonate	< 1	< 1	< 1	< 1	< 1	< 1
Hydroxide	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sulfate	46.0	14.0	25.0	46.0	43.0	36.0
Chloride	80.8	18.0	56.8	75.6	56.0	51.6
Total Dissolved Solids	276	138	270	312	272	274
Total Suspended Solids	47	859	10	15	30	44
Total Alkalinity (as CaCO3)	117	35	78	81	80	99
P-Alkalinity (as CaCO3)	< 5	< 5	< 5	< 5	< 5	< 5
Total Acidity (as CaCO3)	< 5	< 5	< 5	< 5	< 5	< 5
Total Hardness (as CaCO3)	136	49	77	142	93	78
Phosphate-Ortho	0.99	0.17	1.68	1.48	0.64	1.80
Phosphate-Total	1.04	0.79	1.71	1.47	0.64	1.86
Nitrogen-Kjeldahl (organic)	0.81	2.27	1.22	0.98	0.56	0.68
Nitrogen-Kjeldahl (total)	0.93	2.55	1.22	1.26	0.56	1.63
Ammonia	0.12	0.28	< 0.09	0.28	< 0.09	0.95
Nitrate	0.13	0.77	3.38	2.40	1.50	1.31
Nitrite	0.009	0.021	0.047	0.066	0.029	0.023
Fluoride	0.59	0.18	0.56	0.31	0.62	0.64
Organic Carbon, Total (TOC)	15	23	13	8	12	13
Color (color units)	95	65	65	60	< 50	< 50
Phenol	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Oil and Grease, Total	< 5	< 5	< 5	< 5	< 5	< 5
Biochemical Oxygen Demand (BOD)	13	20	8	17	8	8
Chemical Oxygen Demand (COD)	54	32	39	19	23	33
Coliform, Fecal (no./100 mL)	4,500	6,400	152	162	452	136
Total Hardness (as CaCO3)	130	56	112	118	112	96

TABLE 5-19 (Concluded)

Parameter	Sampling Date					
	8-17-81	10-14-81	12-15-81	2-16-82	4-14-82	6-14-82
Total Metals:						
Total Aluminum	0.9	27.0	< 0.1	0.4	0.6	0.4
Total Arsenic	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.011
Total Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Boron	0.19	0.07	0.07	0.06	0.05	0.15
Total Cadmium	< 0.005	< 0.005	0.010	< 0.005	< 0.005	0.005
Total Chromium	< 0.02	0.04	< 0.02	< 0.02	< 0.02	< 0.02
Total Copper	< 0.01	0.18	< 0.01	0.01	< 0.01	< 0.01
Total Iron	1.58	14.60	0.89	1.22	1.85	1.76
Total Lead	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Total Magnesium	11.4	8.9	6.7	8.5	8.6	7.5
Total Manganese	0.27	0.91	0.04	0.19	0.29	0.18
Total Mercury (µg/L)	< 2	< 2	< 2	< 2	< 2	< 2
Total Molybedenum	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Nickel	< 0.02	< 0.02	0.07	< 0.02	< 0.02	< 0.02
Total Selenium	< 0.005	< 0.005	0.007	< 0.005	< 0.005	0.009
Total Strontium	0.17	< 0.05	0.12	0.10	0.15	0.15
Total Zinc	0.02	0.20	0.01	0.02	0.01	0.02
Dissolved Metals:						
Dissolved Aluminum	< 0.1	1.0	< 0.1	< 0.1	< 0.1	< 0.1
Dissolved Arsenic	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.009
Dissolved Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dissolved Boron	0.17	0.05	0.05	0.06	0.03	0.15
Dissolved Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Chromium	< 0.02	0.03	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Copper	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Dissolved Iron	< 0.05	0.46	0.17	0.12	0.07	0.33
Dissolved Lead	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Magnesium	10.7	4.86	5.64	8.25	7.74	7.40
Dissolved Manganese	0.12	0.07	0.02	0.11	0.26	0.12
Dissolved Mercury (µg/L)	< 2	< 2	< 2	< 2	< 2	< 2
Dissolved Molybdenum	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dissolved Nickel	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.008
Dissolved Silica	10	12	20	15	16	17
Dissolved Strontium	0.14	< 0.05	0.10	< 0.05	0.12	0.10
Dissolved Zinc	0.01	0.03	< 0.01	0.02	< 0.01	0.01

All values are reported in mg/L unless noted otherwise.

dissolved constitutents, higher concentrations of nutrients, similar pH and higher dissolved oxygen levels.

One wastewater discharge permit holder is located in the immediate vicinity of the Malakoff EGS. The City of Malakoff's municipal sewage treatment plant outfall is located near the northern boundary of the Malakoff EGS site on an unnamed tributary of Cedar Creek that flows through the project area (Fig. 5-5). TDWR Waste Control Order No. 10738 for Malakoff's discharge specifies daily average and maximum discharge rates of 1,514 and 3,028 kl/da (0.4 and 0.8 mgd), respectively. Both the permitted daily average BOD and total suspended solids (TSS) concentrations are limited to 20 mg/L (TDWR, 1980, 1981b).

Mine. Baseline surface water quality data have been collected for Turkey and Wildcat creeks and the area interior to Henderson County Levee No. 3. A one-year monitoring program was conducted at quarterly intervals during 1978-1979, with the results summarized in Table 5-20. A more recent sampling effort was undertaken in June 1982 to determine any significant changes since the earlier monitoring and to expand the list of parameters analyzed. The results of the June 1982 water quality sampling of Turkey Creek, Wildcat Creek and the interior levee drainage are presented in Table 5-21. The June 1982 monitoring indicates slightly higher pH values, lower dissolved oxygen levels and a higher BOD, and similar TDS concentrations in comparison with the earlier data. The fecal coliform concentration for Turkey Creek was much higher than that of the earlier samples. Most of the other parameters remained within similar ranges.

5.6.2 Impacts of No Action Alternative

If the "no action" alternative is implemented, the surface-water regime of the project area should remain essentially unchanged from existing conditions, barring the possibility that other independent development may occur in the vicinity.

TABLE 5-20

SURFACE WATER QUALITY ANALYSES (1978-1979)

TRINITY MINE AREA

Parameter	Turkey Creek				Wildcat Creek				Flapgate inside Levee			
	3-20-78	6-9-78[a]	10-1-78[a]	1-16-79	3-20-78	6-9-78	10-1-78	1-16-79	3-20-78	6-9-78[a]	10-1-78	1-16-79
Temperature (°C)	20.0			N.A.	19.0	25.5	24.5	N.A.	21.0			N.A.
BOD	4			3	< 1	1	2		5			5
Dissolved Oxygen	8.4			N.A.	8.1	N.A.	10.5	N.A.	8.1			N.A.
Total Suspended Solids	73			50	34	4	18	28	190			32
pH (pH units)	7.2			7.4	7.2	7.9	7.2	7.2	8.0			7.2
Fecal Coliform (no./100mL)	40			40	144	38	64	230	58			50
Turbidity (NTU)	39			60	13.5	4.7	3.3	30	75			32
Chloride	160			78	330	730	750	375	96			195
Nitrate	< .08			2.32	0.26	2.79	4.5	3.04	0.35			2.40
Total Dissolved Solids	428			384	764	1,540	1,636	976	404			564
Cation/anion (meq/L)	5.4/ 6.1			3.2/ 3.4	11.0/ 12.1	22.7/ 23.1	25.1/ 26.1	8.6/ 11.9	3.9/ 4.0			5.7/ 6.3
Sulfate	59			47	106	53	71	22	16			12
Bicarbonate	25			16	46	82	210	54	56			36
Arsenic	< .005			0.013	< .005	<.005	<.005	.006	< .005			0.012
Iron	2.0			3.91	2.0	1.3	0.69	2.34	5.5			1.99
Fluroide	0.05			< .09	0.09	0.6	< .09	< .09	0.12			< .09
Potassium	6.2			7.81	3.5	4.6	14.1	5.74	6.5			7.32
Sodium	66			31.5	130	323	321	72.8	39			58.2
Magnesium	10.3			9.09	33.0	29.1	30.9	15.6	4.8			5.72
Calcium	25.3			13.5	50.0	121	164	77.7	26.8			47.8
Molybdenum	< .1			< .1	< .1	< .1	< .15	< .1	< .1			< .1
Aluminum	4.29			10.6	< .2	< .3	1.02	3.12	13.5			4.17
Cadmium	< .004			< 0.005	< .004	<.006	<.006	< .005	< .004			< .005
Chromium	< .01			< .01	< .01	< .01	< .01	< .01	< .01			< .01
Lead	< .1			< .1	< .1	< .01	< .1	< .1	< 0.1			< .1
Manganese	0.72			0.242	1.64	1.68	0.16	0.944	0.13			0.028
Mercury	0.0011			< .001	0.0024	<.0002	<.002	< .001	<0.0014			< .001
Nickel	< .02			< .02	< .02	< .02	< .03	< .02	< .02			< .02
Selenium	< .5			< .01	< .5	< .05	< 1.	< .01	< .5			< .01
Zinc	0.09			0.18	0.09	0.04	0.33	0.22	0.09			0.22
T-Alkalinity	27			18.5	49	88	218	61.5	58			41

a. Site was dry on sampling date.

N.A. - not measured.

(All values reported in mg/L

TABLE 5-21
SURFACE WATER QUALITY ANALYSES (1982)
TRINITY MINE AREA

Parameter	Sampling Site		
	Turkey Creek[b]	Wildcat Creek[c]	Flap-Gate[d]
pH[a]	7.1	7.8	7.8
Water Temperature[a] (°C)	25	27	26
Dissolved Oxygen[a] (ppm)	3.9	7.2	6.5
Specific Conductance[a] (micromhos/cm)	830	1,790	670
pH (lab)	7.60	8.00	8.00
Specific Conductance, lab (micromhos/cm)	880	1,120	620
Turbidity (NTU)	53.0	19.0	48.0
Major Cations			
Calcium	42.8	115	41.4
Magnesium	23.4	21.4	5.50
Sodium	80.6	194	57.2
Potassium	7.02	6.22	5.86
Iron	<0.02	0.15	0.14
Major Anions			
Bicarbonate	103	188	133
Carbonate	< 1	< 1	< 1
Hydroxide	< 0.5	< 0.5	< 0.5
Sulfate	85.0	22.0	21.0
Chloride	162	430	114
Settleable Solids	1	< 1	< 1
Total Dissolved Solids	562	1,130	440
Total Suspended Solids	46	34	54
Total Alkalinity (as $CaCO_3$)	86	156	110
P-Alkalinity (as $CaCO_3$)	< 5	< 5	< 5
Total Acidity (as $CaCO_3$)	< 5	< 5	< 5
Total Hardness (as $CaCO_3$)	203	375	126
Phosphate-Ortho	0.02	<0.01	0.10
Phosphate-Total	0.02	0.03	0.15
Nitrogen-Kjeldahl (Organic)	1.39	1.01	1.21
Nitrogen-Kjeldahl (Total)	1.63	1.12	1.30
Ammonia (NH_3-N)	0.24	0.11	<0.09
Nitrate (NO_3-N)	0.20	0.18	0.37
Nitrite (NO_2-N)	0.014	0.002	0.021
Fluoride	0.43	0.44	0.28
Organic Carbon, Total (TOC)	11	7	3
Color (Color Units)	< 50	< 50	< 50
Phenol	<0.002	<0.002	<0.002
Oil and Grease, Total	< 5	< 5	< 5
Biochemical Oxygen Demand (BOD)	18	22	22
Chemical Oxygen Demand (COD)	33	27	26
Coliform, Fecal (no./100 mL)	2,950	44	24
Total Hardness (as $CaCO_3$)	245	378	178
Boron	0.06	0.13	0.09
Manganese	1.71	2.16	0.03
Silica	12	18	7
Total Aluminium	0.8	0.3	0.7
Total Arsenic	<0.005	0.008	0.012
Total Beryllium	<0.01	<0.01	<0.01
Total Boron	0.07	0.14	0.10
Total Cadmium	<0.005	<0.005	<0.005
Total Chromium	<0.02	<0.02	<0.02
Total Copper	<0.01	<0.01	<0.01
Total Iron	2.02	0.79	0.91
Total Lead	0.006	<0.005	<0.005
Total Magnesium	23.5	22.8	5.6
Total Manganese	1.71	2.27	0.13
Total Mercury	< 2	< 2	< 2
Total Molybdeum	< 0.1	< 0.1	< 0.1
Total Nickel	<0.02	<0.02	<0.02
Total Selenium	<0.005	<0.005	<0.008
Total Strontium	0.48	1.14	0.39
Total Zinc	0.03	0.03	0.02

a. Field measurements.

b. At F. M. 90.

c. Approximately 1.6 km (1 mi) upstream of confluence with Trinity River.

d. Within Trinity River Levee.

Note: All values are reported on a dissolved basis in mg/L unless indicated otherwise.

5.6.3 Impacts of Project Alternatives

5.6.3.1 Impacts of Construction

Power Station.

Surface-Water Hydrology. Construction activities for the Malakoff EGS will result in some short-term impacts on the surface-water hydrology on and adjacent to the site. Activities such as timber and brush clearing, excavation, embankment and road construction, and site preparation will alter local drainage patterns, overland runoff characteristics and sediment loadings.

Surface-Water Quality. Construction activities related to development of the power station will result in some short-term impacts on the surface-water quality within and adjacent to the site. Removal of vegetation from the site, as well as disturbance of topsoil associated with construction of operational and surface-water control facilities, will increase erosion potential and add to sediment loadings in runoff from the area. Localized sediment control measures such as straw dikes, vegetative filter strips and check dams will be implemented as necessary to minimize potential adverse impacts on surface-water quality resulting from increased erosion and sediment loadings in the construction area. Fertilizer used to assist in revegetation of the area may result in a short-term increase in nutrient levels of runoff into Walnut Creek and Cedar Creek, the primary receiving streams.

Makeup Water Pipeline. Construction impacts associated with the makeup water pipeline will result in some short-term effects on the surface water resources of the area. The primary surface water impacts of construction will be increased sediment loadings to the various streams in the Neches and Trinity river basins to be crossed by the pipeline. Surface water impacts will be most prevalent at the construction site of the pump station and intake structure on the Neches River channel impoundment, while construction impacts will be experienced to a lesser degree at the sites of the various minor stream crossings by the pipeline. Increased turbidity, reflecting high suspended solids concentrations, may occur at these locations if periods of intense or prolonged rainfall occur during the period of construction. Localized control measures will be implemented as necessary to minimize these effects. Any effects of pipeline construction on runoff rates and volumes should be very minor as a result of the small acreages to be affected within any particular watershed. The overall effects of the makeup water pipeline construction activities upon surface water characteristics will be of short-term duration, essentially ceasing upon completion of construction and revegetation of the disturbed areas.

Mine.

Surface-Water Hydrology. Activities related to construction of the Trinity Mine will result in some short-term impacts on the surface-water hydrologic regime on and adjacent to the mine site. Excavation and grading activities in connection with the construction of overland flow diversion facilities, sedimentation ponds and other surface water and erosion control measures to be implemented prior to mining, in accordance with the RRC surface mining regulations, will alter existing drainage patterns, overland runoff volumes, peak runoff rates and sediment loadings. Also affecting the hydrologic characteristics of the site will be other activities associated with development of the mine facility, e.g., timber and brush clearing, road relocation and construction, construction of stream diversions and site preparation and construction of shop facilities. These operations will result in temporary reductions of streamflow in some areas (e.g., below stream diversions). Runoff will increase in other locations such as temporarily denuded areas and streams receiving runoff diverted from adjacent watersheds.

Erosion control measures, such as those noted previously to be used during power station construction, will be employed as necessary to minimize the potential adverse effects of mine construction on runoff and erosion. Therefore, overall effects of mine-related construction activities on the surface-water hydrology in the vicinity of the project area should be temporary and minor.

Surface-Water Quality. Mine development will require construction activities that will have some short-term effects on the surface-water quality within and adjacent to the mine site. Activities such as road relocations and construction and site preparation will cause some increases in sediment production. In addition, excavation and grading work in connection with the construction of overland flow diversion facilities and sedimentation ponds is expected to result in short-term increases in sediment production. Areas in which only diversion ditches, sedimentation ponds, or roads are installed prior to mining activities are not subject to compliance with effluent limitations for runoff from disturbed areas. However, actual mining operations (e.g., clearing of vegetation, removal of topsoil, overburden and lignite) are subject to runoff control by sedimentation ponds and compliance with the applicable effluent limitations.

The overall effects of mine-related construction activities on the surface-water quality of the area should be minor in magnitude and of short-term duration. Current available technology will be used as necessary during construction to minimize sediment production.

Combined.

Surface-Water Hydrology. Combined construction activities of the mine and power station will be, for the most part, additive in their effect on the hydrologic characteristics of the area during the period of simultaneous construction in specific areas (e.g., the Walnut Creek watershed). Both operations will require a certain amount of timber and brush clearing, resulting in short-term local increases in peak runoff rates and overland runoff volumes. The combined effects of the clearing activities and earthwork associated with the construction of the mine and power station operations and surface-water control facilities will temporarily increase the potential for erosion and the resultant sediment loadings. Adverse hydrologic impacts will be minimized upon completion of the surface-water control facilities. Sedimentation ponds will attenuate flood peaks in addition to their primary function of controlling suspended solids in mine and power station runoff waters.

Construction effects of the power station will terminate upon its completion. However, construction impacts of the mine will continue, to a degree, throughout the project life as mining progresses, requiring new construction activities at various points in time (e.g., haul roads, stream diversions, levees, etc.).

Water Quality. Water quality impacts due to construction of the combined mine and power station should essentially be additive during the period of simultaneous construction in areas of common influence (e.g., the Walnut Creek watershed). However, power station construction impacts on the water quality will cease upon completion of the power station and associated facilities, while mine construction impacts (except for the initial primary facility construction) will occur at varying locations throughout the life of the project such as haul roads, sedimentation ponds and stream reroutes.

5.6.3.2 Impacts of Operation

Power Station.

Surface-Water Hydrology. The principal operational effects of the proposed Malakoff EGS upon the hydrologic characteristics of the area will be related to alteration of the natural site drainage by the plant drainage system, changes in runoff characteristics of areas affected by the plant, and the impoundment of runoff from the lignite storage and material handling areas in sedimentation ponds. Portions of the plant site will exhibit higher runoff volumes per unit area than under existing conditions as a result of increases in impervious area and clearing of vegetation. Table 5-22 presents an estimate of the increases in runoff volume from the disturbance area of the plant site proper for a range of storm events. Due to the relatively small acreage within the plant site disturbance area (approximately 426 ha (1,066 ac)), in comparison to the drainage areas of the Cedar and Walnut creek watersheds, the effects of the increased runoff volumes on the receiving streams should be very minor. As the plant site area proper will be graded flat, peak runoff rates from this area should actually decrease in comparison with existing conditions. Additionally, peak runoff rates from the lignite storage and material handling areas will be attenuated by retention ponds, which are designed to impound and treat inflows from a 10-year, 24-hour storm event.

Surface-Water Quality. The primary impacts of the proposed power station on surface-water quality will result from the various wastewater streams to be produced and discharged by the plant. As the liquid waste management system is designed to maximize reuse to the extent possible, most wastes will be used directly in other systems within the plant. Liquid wastes which are not reused directly will be collected, treated, as necessary, and either reused or discharged. During normal plant operation, a total of approximately 7.0 Kl/da (1,850 gpm) will be reused while approximately 1.8 Kl/da (475 gpm) will be discharged off site. Treated power plant wastewaters will be discharged to Cedar Creek, Walnut Creek or unnamed tributaries thereof, and will ultimately enter Segment 0804 of the Trinity River.

Wastewater discharges from Malakoff EGS will be subject to regulation under applicable sections of 40 CFR 423, Effluent Guidelines and Standards for Steam Electric Power Generating Stations. As the plant has been designated a "new source" by EPA, New Source Performance Standards (NSPS) are applicable (40 CFR 423.15). These performance

TABLE 5-22
ESTIMATED EFFECTS OF POWER PLANT SITE DEVELOPMENT ON RUNOFF VOLUMES
MALAKOFF EGS

Storm Recurrence Interval and Duration	Total Rainfall[a] (in.)[d]	Total Runoff		Net Increase (in.)
		Existing[b] (in.)	Operational[c] (in.)	
1-year, 6-hour	2.6	0.54	1.79	1.25
2-year, 6-hour	3.2	0.88	2.35	1.47
5-year, 6-hour	4.2	1.53	3.31	1.78
10-year, 6-hour	4.9	2.04	3.99	1.95
25-year, 6-hour	5.9	2.82	4.97	2.15
50-year, 6-hour	6.6	3.39	5.66	2.27
100-year, 6-hour	7.4	4.06	6.45	2.39
1-year, 24-hour	3.4	1.00	2.54	1.54
2-year, 24-hour	4.3	1.60	3.41	1.81
5-year, 24-hour	5.8	2.74	4.87	2.13
10-year, 24-hour	6.9	3.64	5.96	2.32
25-year, 24-hour	8.0	4.58	7.04	2.46
50-year, 24-hour	9.1	5.55	8.13	2.58
100-year, 24-hour	10.2	6.54	9.23	2.69

[a] Point rainfall depths were obtained from Technical Paper 40, U. S. Weather Bureau (Hershfield, 1961).

[b] Runoff for existing conditions was based on an average SCS runoff curve number of 71.

[c] Runoff for operational conditions was based on an assumed runoff curve number of 92.

[d] For metric unit equivalent, please refer to metric conversion table in the Glossary.

standards require that the pH of the effluent be within the range of 6.0 to 9.0 and further stipulate no discharges of polychlorinated biphenyl compounds (PCB's). The NSPS also regulate discharges from low-volume waste sources, metal cleaning wastes, bottom ash and fly ash transport water, runoff storage pond and total residual chlorine discharges from biocide treatment systems. NPDES permits for new source discharges are issued with effluent limitations based upon 40 CFR 423.15.

As noted in the draft NPDES permit for the Malakoff EGS (Appendix B), a total of six discharge points will exist in conjunction with the generating station. General information on the various waste streams, by outfall number, are as follows:

Outfall 001

Location:	discharge point from stormwater treatment system clarifier
Source:	lignite pile runoff comingled with cooling tower blowdown and low volume wastes
Flow Characteristic:	intermittent (daily max. 0.720 MGD)
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	30mg/L	100mg/L
Oil and Grease	15mg/L	20mg/L
Free Available Chlorine	02.mg/L	0.5mg/L
Temperature	N/A	33.9°C (93° F)
Selenium	N/A	0.10(instantaneous max.)

Outfall 002

Location:	discharge location from runoff sedimentation pond(s)
Source:	material storage area runoff and washdown water
Flow Characteristic:	intermittent
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	50mg/L	N/A
Selenium	N/A	0.1mg/L (instantaneous max.)

Outfall 003

Location:	discharge point from floor drainage treatment system
Source:	low volume wastewaters from floor drainage
Flow Characteristic:	intermittent (daily max. 0.55 MGD)
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	30mg/L	100mg/L
Oil and Grease	15mg/L	20mg/L

Outfall 004

Location:	discharge point from chemical waste treatment system
Source:	demineralizer regenerate and other low volume waste streams
Flow Characteristic:	intermittent (daily max. 0.173 MGD)
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	30mg/L	100mg/L
Oil and Grease	15mg/L	20mg/L

Outfall 005

Location:	discharge point from metal cleaning waste treatment system
Source:	metal cleaning wastes, comingled with low volume wastes and ash transport water
Flow Characteristic:	intermittent (daily max. 0.216 MGD)
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	30mg/L	100mg/L
Oil and Grease	15mg/L	20mg/L
Total Iron	1.0mg/L	1.0mg/L
Total Copper	1.0mg/L	1.0mg/L
Selenium	0.05mg/L	0.1mg/L

Outfall 006

Location:	discharge point from sanitary waste treatment system
Source:	sanitary wastes
Flow Characteristic:	daily avg. 0.07 MGD; daily max. 0.144 MGD
Effluent Limitations:	

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	20mg/L	45mg/L
Biochemical Oxygen Demand (5-day)	20mg/L	45mg/L

In addition, the pH of effluents from all six outfalls must be within the range of 6.0-9.0, and there shall be no discharge of floating solids or visible foam in other than trace amounts. In general, as all waste streams to be generated by the power plant are subject to applicable effluent limitations and state water quality standards, adverse impacts of these discharges on the water quality of the receiving streams will be avoided.

Makeup Water Pipeline. Operational impacts of the makeup water pipeline on surface water resources will be related primarily to the trans-basin diversion of water from the Neches River channel impoundment, located approximately 19.3 km (12 mi) northeast of Palestine in the Neches River Basin, to the plant site near Malakoff in the Trinity River Basin. The estimated average annual makeup water requirement of 17,885,561 m^3 (14,500 ac-ft) per year for the two-unit operation will be supplied under contract with the Upper Neches River Municipal Water Authority.

While the consumptive use of water by the Malakoff EGS due to forced and natural evaporation and other losses represents a deficit in the overall water balance of the area, the proposed usage is not expected to result in adverse impacts on the water resources of either the Neches or Trinity river basins. The average annual diversion of 17,885,561 m^3 (14,500 ac-ft) per year from the Neches River Basin to the Trinity River Basin represents only 3 percent of the average annual flow of the Neches River at the USGS gage near Neches, in the vicinity of the diversion point, which averaged 596,021,000 m^3 (483,200 ac-ft) per year during the period 1962-1980. The proposed diversion is less than 0.4 percent of the average annual flow of the Neches River at the USGS gage at Evadale, in the lower portion of the basin, which averaged 4,806,899,000 m^3 (3,897,000 ac-ft) per year during the period 1965-1980 (USGS, 1981). Annual discharges to the Trinity River Basin of wastewaters originating from the Neches River Basin will average less than 209,700 m^3 (170 ac-ft) per year. As determined from a review of downstream water demands and water availability undertaken as a part of the water supply studies for the project (Turner, Collie and Braden, 1980), water availability in the Neches River Basin exceeds in-basin needs, as required by the TDWR as a condition for allowing the transfer of water out of the basin. Additionally, the trans-basin diversion of water from east to west within Texas is in accordance with the State's water plan (TWDB, 1968), which envisions the transfer of surplus surface waters in eastern portions of the state to water-deficient areas to the west.

Mine.

Surface-Water Hydrology. The hydrologic characteristics of the mine site will be subject to continual change as mining operations progress. Vegetation and overburden removal, lignite excavation, temporary topsoil and lignite stockpiling, construction and removal of interceptor ditches, sedimentation ponds, diversion channels and other surface-water control facilities, haulroad construction and relocation, and reclamation activities will serve to maintain the hydrologic characteristics of the site in a constant state of flux. Among the characteristics that will be subject to change during mining are areal extent and shape of drainage basins, topography, nature and density of vegetative cover and soil composition and condition. Floodwaters within the site itself will be controlled by the surface-water control system. Sedimentation ponds will substantially reduce flood peaks at their points of discharge from the site into the receiving streams. However, the effects upon the flood peaks of the major streams in the vicinity of the project area will be minor because of differences in drainage areas and lag times between the receiving streams and the local tributaries.

The SCS TR-20 model was utilized to simulate postmining runoff response for comparison with the premining conditions discussed in Sec. 5.6.1.5. As a result of regulatory requirements that surface mined lands be reclaimed to approximate original contour, it was assumed that postmining sub-watershed topographic characteristics and stream routing characteristics would not change substantially from premining conditions. However, runoff curve numbers were altered to reflect potential changes in soil and land use characteristics. For comparative runoff modeling purposes, a reclamation scenario corresponding to the use of mixed overburden as the postmining surface soil medium and a postmining land use of 100 percent coastal bermudagrass pasture was assumed. A runoff curve number of 74 was assigned to areas to be mined within each sub-watershed based on a reconstructed soil having a runoff potential similar to hydrologic soil Group C (moderately high runoff potential) and a land use of pasture or rangeland in good condition. Composite postmining curve numbers were then computed for each sub-watershed for use in the postmining modeling (NACCO, 1982).

A comparison of the estimated premining and postmining peak flows and runoff volumes of the study area watersheds (Fig. 5-8) is presented in Table 5-23 for the assumed reclamation scenario of 100 percent pasture on mixed overburden. The comparative assessment is provided as an indication of trends which may be expected based on these assumptions regarding postmining soil characteristics and land use. For the Turkey Creek watershed, an overall reduction in peak flows and runoff volumes was predicted. Peak flow reductions ranged from 3.1 percent for the 100-year, 24-hour storm to 8.6 percent for the 2-year, 24-hour storm and runoff volume reductions ranged from 1.8 percent to 3.8 percent. However, slight increases in peak inflow rates, ranging from 2.3 to 6.9 percent, and runoff volumes, ranging from 1.2 to 2.9 percent, were predicted for Walnut Creek. For the Interior Levee watershed, peak flow reductions ranged from 9.9 percent to 21.1 percent and runoff volume reductions ranged from 7.4 percent to 15.6 percent. For the Wildcat Creek watershed, peak flow reductions ranged from 0.1 percent to 0.6 percent. For the southern watersheds, sub-watershed SW-1 peak flow reductions ranged from 7.0 percent to 17.4 percent and runoff volume reductions ranged from 7.1 percent to 14.6 percent. For sub-watershed SW-3, peak flow increases ranged from 9.4 percent to 27.2 percent and runoff volume increases ranged from 9.6 percent to 21.4 percent. For sub-watershed SW-7, peak flow reductions ranged from 4.9 percent to 12.2 percent and runoff volume reductions ranged from 5.0 percent to 10.2 percent (NACCO, 1982).

With regard to the effect of mining on study area watersheds, a slight overall reduction in runoff potential is predicted for the reclamation alternative of 100 percent pasture on mixed overburden. The minimum reduction is noted for the Wildcat Creek watershed, while the largest reduction is predicted for the interior levee watershed. The amount of reduction depends upon the percentage of the watershed scheduled to be mined and the premining runoff potential of the watershed. This projected overall reduction in runoff potential is a result of predicted increased infiltration characteristics of the reconstructed soil in association with the assumed postmining land cover of 100 percent coastal bermudagrass pasture. As all of the affected watersheds are very small in comparison to

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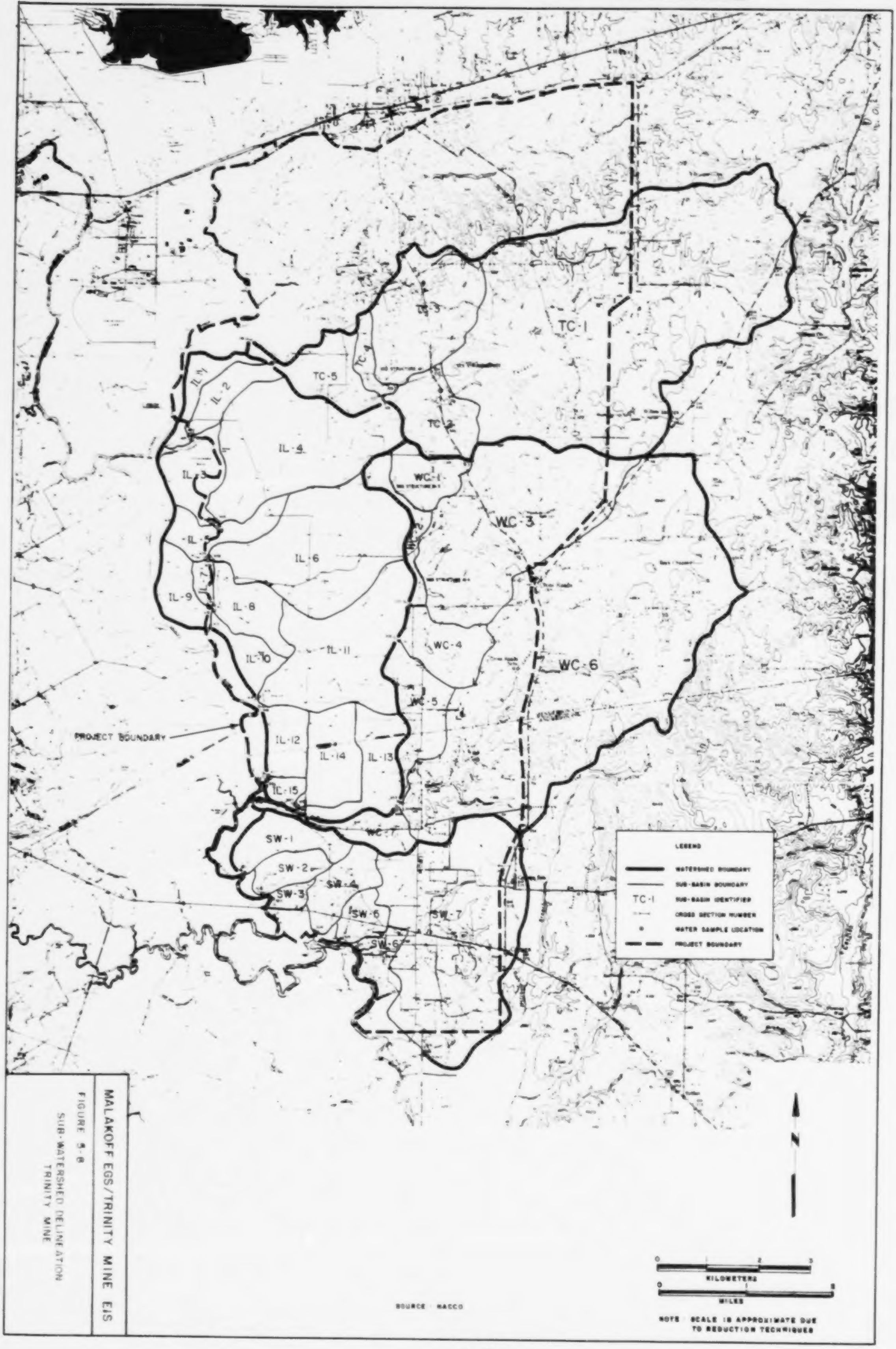
TC-1
TC-2
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WC-4
WC-5
WC-6
WC-7
SW-1
SW-2
SW-3
SW-4
SW-5
SW-6
SW-7
PROJECT BOUNDARY
LEGEND
WATERSHED BOUNDARY
SUB-BASIN BOUNDARY
TC-1 SUB-BASIN IDENTIFIER
CROSS SECTION NUMBER
WATER SAMPLE LOCATION
PROJECT BOUNDARY
N
0 1 2 3
KILOMETERS
0 1 2
MILES
NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES
SOURCE: NACCO

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-6

SUB-WATERSHED DELINEATION
TRINITY MINE

TABLE 5-23

SUMMARY OF PREMINING VS. POSTMINING RUNOFF DATA

TRINITY MINE[a]

Watershed	Cross Section	Drainage Area (mi^2)	Storm	Rainfall (in.)	Peak Flow Premining (cfs)	Peak Flow Postmining (cfs)	Peak Flow % Change (+/-)	Runoff Volume Premining (ac-ft)	Runoff Volume Postmining (ac-ft)	Runoff Volume % Change (+/-)
Turkey Creek	108	27.38	2-yr, 24-hr	4.1	803	734	-8.6	2,278.8	2,190.4	-3.8
			5-yr, 24-hr	5.6	1,410	1,325	-6.0	3,950.1	3,825.9	-3.1
			10-yr, 24-hr	6.6	1,841	1,750	-4.9	5,152.4	5,023.3	-2.5
			50-yr, 24-hr	8.7	2,783	2,682	-3.6	7,818.4	7,666.4	-1.9
			100-yr, 24-hr	9.8	3,288	3,184	-3.1	9,266.0	9,097.5	-1.8
Walnut Creek	(downstream of Turkey Creek)	65.96	2-yr, 24-hr	4.0	3,104	3,318	+6.9	2,782.9	2,864.4	+2.9
			5-yr, 24-hr	5.5	5,980	6,290	+5.2	5,089.7	5,209.6	+2.4
			10-yr, 24-hr	6.5	8,129	8,490	+4.4	6,785.8	6,928.0	+2.1
			50-yr, 24-hr	8.6	12,999	13,442	+3.4	10,665.3	10,816.4	+1.4
			100-yr, 24-hr	9.6	15,744	16,100	+2.3	12,733.2	12,889.4	+1.2
Interior Levee	422	25.58	2-yr, 24-hr	4.1	1,749	1,380	-21.1	2,523.9	2,128.2	-15.6
			5-yr, 24-hr	5.6	2,905	2,432	-16.3	4,188.3	3,683.5	-12.0
			10-yr, 24-hr	6.6	3,718	3,190	-14.2	5,375.2	4,815.9	-10.4
			50-yr, 24-hr	8.7	5,482	4,873	-11.1	7,953.7	7,298.8	-8.2
			100-yr, 24-hr	9.8	6,425	5,784	-9.9	9,345.2	8,649.4	-7.4
Wildcat Creek	206	32.38	2-yr, 24-hr	4.1	2,752	2,734	-0.6	2,397.8	2,296.8	-4.2
			5-yr, 24-hr	5.6	5,185	5,166	-0.3	4,272.1	4,161.9	-2.6
			10-yr, 24-hr	6.6	6,985	6,966	-0.3	5,637.3	5,508.9	-2.3
			50-yr, 24-hr	8.7	11,025	11,009	-0.1	8,697.2	8,548.3	-1.7
			100-yr, 24-hr	9.8	13,233	13,217	-0.1	10,371.9	10,223.4	-1.4
Southern	301	1.26	2-yr, 24-hr	4.3	545	450	-17.4	124.3	106.1	-14.6
			5-yr, 24-hr	5.8	923	805	-12.7	205.6	182.1	-11.4
			10-yr, 24-hr	6.9	1,215	1,086	-10.6	268.8	241.9	-10.0
			50-yr, 24-hr	9.1	1,819	1,674	-7.9	401.2	369.6	-7.8
			100-yr, 24-hr	10.2	2,125	1,976	-7.0	469.7	436.1	-7.1
Southern	303	0.27	2-yr, 24-hr	4.3	147	187	+27.2	17.3	21.0	+21.4
			5-yr, 24-hr	5.8	286	338	+18.2	31.5	36.7	+16.5
			10-yr, 24-hr	6.9	399	458	+14.8	43.2	49.2	+13.9
			50-yr, 24-hr	9.1	641	710	+10.7	68.7	76.0	+10.6
			100-yr, 24-hr	10.2	767	839	+9.4	82.1	90.0	+9.6
Southern	306	8.18	2-yr, 24-hr	4.3	2,112	1,854	-12.2	807.1	724.2	-10.2
			5-yr, 24-hr	5.8	3,565	3,244	-9.0	1,335.0	1,225.9	-8.2
			10-yr, 24-hr	6.9	4,690	4,337	-7.5	1,745.0	1,618.5	-7.2
			50-yr, 24-hr	9.1	7,015	6,621	-5.6	2,604.5	2,456.2	-5.7
			100-yr, 24-hr	10.2	8,198	7,791	-4.9	3,045.1	2,892.4	-5.0

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[a] For metric unit equivalents, please refer to metric conversion table in the Glossary.

the Trinity River, which is the ultimate receiving stream for all streams to be affected by the mining operations, and since slight increases in runoff potential are predicted for some streams, the overall change in runoff potential is not expected to result in adverse impacts on downstream flows or water availability. For example, the projected decrease in runoff volume from a 100-year, 24-hour storm of 696 ac-ft (from 9,345 ac-ft to 8,649 ac-ft) within the area protected by Henderson County Levee No. 3 represents less than 0.03 percent of the mean annual discharge of the Trinity River at Trinidad (approximately 2,600,000 ac-ft/yr). Lesser effects would be experienced during storms of smaller magnitude than a 100-year, 24-hour storm. Additionally, as floodwaters are impounded within the levee system whenever runoff rates to the levee outlet pipes exceed the discharge capacity of the pipes, or whenever the flap gates are closed due to high stages on the Trinity River, potential downstream impacts attributable to changes in runoff rates within the reclaimed areas protected by the levee system will be very minimal.

As noted previously, the postmining hydrologic modeling was based on the assumption of 100 percent pasture as the postmining land use and a mixed overburden surface soil of moderately-high runoff potential. Other reclamation alternatives include re-establishment of premining land use (combinations of pasture and woodland) with topsoil replacement, 100 percent pasture in conjunction with topsoil replacement and re-establishment of premining land use on mixed overburden.

If topsoil is replaced and premining land use is re-established, the runoff potential of the reclaimed areas should not differ appreciably from the premining runoff potential (Table 5-14). This reclamation scenario would approximate the major factors influencing premining runoff, including topography, stream patterns, soil conditions and land use. However, minor localized changes in runoff characteristics would still be expected because the physical features of the watersheds (topography, spatial distribution of topsoil, etc.) cannot be duplicated exactly. This reclamation alternative would be expected to result in less change in runoff potential than other alternatives.

In the case of a reclamation scenario involving topsoil replacement and 100 percent pasture as the postmining land use, slight overall increases in runoff rates and volumes would be expected in comparison with premining conditions. These increases would be attributable to the changes in land use (e.g., the replacement of woodlands with pasture, which has a higher runoff potential), as the other major factors influencing runoff would approximate existing conditions.

If premining land use is re-established on mixed overburden, the overall postmining runoff potential would be reduced slightly from that predicted for the 100 percent pasture on mixed overburden alternative which was assumed for the postmining runoff modeling (Table 5-23). This reduction would be attributable to the re-establishment of woodlands on portions of the site instead of 100 percent pasture, as assumed for the postmining modeling. As the results of the postmining modeling indicated an overall decrease in runoff potential within the project area (although increases were projected for some of the watersheds), the reclamation alternative of re-establishing premining land use on mixed overburden would be expected to result in slightly greater overall reduction in runoff potential than indicated by the modeling results in Table 5-23.

In summary, the various reclamation alternatives can be expected to result in somewhat different postmining runoff responses. However, the magnitude of premining versus postmining changes attributable to any of the reclamation alternatives noted should be minor for the reasons noted previously (the small size of the affected watersheds in comparison to the Trinity River Basin and the storage effects on flood discharges within the levee system). Adverse impacts on streamflow or water availability downstream of the mine area are not anticipated regardless of the reclamation alternative selected for the Trinity Mine.

The SCS floodwater retarding structures in the project area to be affected by the mining operations will be replaced during reclamation. The structures will be designed and constructed in accordance with SCS specifications.

Surface-Water Quality. Potential surface-water quality impacts of mine operation will arise from several sources. The first waste stream affecting surface-water quality will result from surface runoff from disturbed areas, which will be collected in sedimentation ponds. Other waste streams will include seepage into the active pit, direct rainfall into the active pit, domestic sewage and vehicle washwaters. Wastes from all of these sources will be routed to sedimentation ponds prior to discharge to receiving streams.

The draft NPDES permit for the mine (Appendix B) provides drainage and discharge plans for the construction and first five years of operation. Plans for the remainder of the project will be included in subsequent NPDES permit applications. A total of 13 discharge points will be authorized under the NPDES permit for the initial five-year period. Basic data on these 13 outfalls are as follows:

Outfalls 001-012

Locations: discharge points from sedimentation ponds

Sources: 001 - facilities area runoff and treated domestic wastewater (from Outfall 101);

002 - dragline erection site runoff and disturbed mining area runoff;

003 through 012 - disturbed mining area runoff.

Flow Characteristics: intermittent

Effluent Limitations:

Parameter	Daily Avg.	Daily Max.
Total Suspended Solids	35.0mg/L	70.0mg/L
Total Iron	3.0mg/L	6.0mg/L
Total Manganese	2.0mg/L	4.0mg/L

In addition, pH of the effluents must fall within the range of 6.0-9.0. Discharges resulting from precipitation within a 24-hour period less than or equal to the 10-year, 24-hour precipitation event may comply with an effluent limitation for settleable solids of 0.5 mL/L (daily maximum) instead of the otherwise applicable limitations. If the 10-year, 24-hour precipitation is exceeded, only the pH limitation (6.0-9.0) is applicable. The 0.5 mL/L limitation on settleable solids (daily maximum) also applies to discharges from reclamation areas until performance bond is released.

Outfall 101

Location: discharge point from wastewater treatment plant, upstream of sedimentation pond with Outfall 001.

Source: domestic wastewater

Effluent Limitations:

Parameter	Daily Avg.	Daily Max.
Biochemical Oxygen Demand	0.5 Kg/day (1 lb/day)	0.9 Kg/day (2 lb/day)
Total Suspended Solids	0.5 Kg/day (1 lb/day)	0.9 Kg/day (2 lb/day)

TDWR monitoring and reporting requirements for nondomestic discharges will also be applicable to the mine discharges, as will TDWR's effluent limitations for hazardous metals discharged to inland waters.

A review of available overburden geochemistry data for cores in the mine area was conducted to evaluate potential impacts on runoff water quality from disturbed and reclaimed areas under the various alternative reclamation schemes. Concentrations of heavy metals in the core samples were compared to common ranges and averages typically observed in surface soils. In general, the chemical data on the overburden cores indicate that heavy metal toxicity should not be a problem in surface runoff from the active mining and reclaimed areas, regardless of the reclamation scheme selected (topsoil replacement, oxidized overburden over unoxidized overburden, total overburden mix, etc.). It was noted that data from cores analyzed in 1978 showed selenium concentrations on the order of ten times higher than the more recent (1981) cores. This discrepancy is attributed to the laboratory procedures in use during 1978, which typically over-estimated selenium concentrations by a factor of ten or more. The overburden geochemistry data indicate that any of the reclamation alternatives will result in a soil material characterized by heavy metal concentrations, including selenium, within the ranges normally found in surface soils. The available information also indicates that neither iron nor manganese should pose serious problems in mine runoff waters, regardless of the reclamation alternative selected with regard to topsoil or mixed overburden.

The results of the overburden geochemistry review indicate that acidity should not be a problem in runoff waters regardless of the reclamation scheme implemented. Most of the pyritic material is located immediately above or below the lignite seams, and will either be buried in the pit or removed. Core data generally indicate adequate buffering capacity to neutralize acidity throughout the overburden core. While localized instances of surface or near-surface acid-forming materials may occur, their existence will be detected by soil sampling, surface-water monitoring and observance of revegetation success, and mitigative measures will be undertaken as necessary. As noted previously, discharges from sedimentation ponds will be subject to EPA's new source performance standards for coal mine discharges as well as TDWR's effluent limitations on hazardous metals discharged to inland waters, and impounded stormwater runoff will be treated, if necessary, to comply with the applicable criteria.

Sedimentation ponds will be constructed as necessary to control runoff from disturbed areas, and will include both conventional embankment-type structures in natural drainageways and excavated off-channel ponds. Each sedimentation pond will contain, in addition to 0.1 acre-foot of sediment storage capacity for each acre of disturbed area draining to the pond, sufficient flood storage capacity to provide a minimum detention time of 24 hours for the runoff resulting from a 10-year, 24-hour storm. Following the impoundment of stormwater and treatment, as necessary, to meet the applicable effluent limitations, the sedimentation ponds will be dewatered to the sediment storage level by gravity, pump or siphon. Pit seepage and rainfall collected in the active pits will be collected in sumps and pumped to sedimentation ponds for treatment, if necessary, prior to discharge. The locations of sedimentation pond discharges associated with the mine will vary throughout the life of the project, reflecting the progression of the mining and reclamation activities. Various streams, including the Trinity River, Walnut Creek, Turkey Creek, Prairie Creek, Wildcat Creek, the interior levee drainage and various tributaries will serve as receiving streams for sedimentation pond discharges during the life of the project. Domestic wastewater generated at the mine facilities will be treated in an on-site treatment facility prior to discharge to Walnut Creek.

Combined.

Surface-Water Hydrology. Operational impacts of the combined mine and power station on streamflow characteristics should essentially reflect the sum of their individual impacts at any given time in areas of common influence (e.g., the Walnut Creek watershed). The power station operational impacts will be virtually static throughout the life of the project, while mining impacts will vary continuously with respect to time and location. Under operational conditions, the slight overall reduction in runoff potential for reclaimed areas of the mine may be partially offset by power plant effluent discharges, estimated at 944,850 m^3 (766 ac-ft) per year, and possibly, ground-water depressurizing system discharges, which may range from 198,887 m^3 (161 ac-ft) per year to 596,662 m^3 (484 ac-ft) per year. Due to the magnitude of flows in the Trinity River (mean annual discharge at Trinidad averages approximately 3.2×10^9 m^3 (2.6×10^6 ac-ft) per year), any decreases or increases in flow from the combined project area are not expected to result in adverse impacts on the flow regime of the Trinity River.

Surface-Water Quality. Operation of the mine and power station will be, for the most part, independent with regard to their effect on the water quality on and adjacent to the site. Power station discharges will affect the same receiving streams throughout the life of the project, while mine operational impacts on water quality will affect various watercourses, reflecting the progression of mining and reclamation activities.

5.6.3.3 Cumulative

Surface-Water Hydrology. The cumulative impacts of the Malakoff EGS/Trinity Mine and other activities in the area on surface-water hydrology and water availability, if any, will essentially be additive within their areas of common influence. However, major areas of cumulative surface-water impacts are not anticipated. The primary surface-water impact of the project in terms of downstream water availability will involve the diversion of power plant makeup water from the Neches River. The effects of multiple diversions from a particular stream (e.g., the Neches River) are essentially cumulative inasmuch as any diversion affects downstream water availability. However, the makeup water supply for the power plant will be obtained under UNRMWA's existing water use permit for Lake Palestine. Issuance of this permit by the TDWR required, in accordance with the Texas Water Code, a determination that unappropriated water was available in the source of supply for the requested diversion. Hence, in issuing the UNRMWA water use permit, TDWR determined that unappropriated water was available, taking into consideration the cumulative effects on existing water rights in the Neches River Basin. Therefore, adverse impacts of the proposed diversion on water availability downstream of the diversion are not anticipated.

Other proposed projects in the general area of the Malakoff EGS/Trinity Mine Project (e.g., Richland-Chambers Reservoir, Forest Grove Mine and Power Plant) will result in some surface-water impacts, such as changes in streamflow characteristics and reservoir evaporation. However, cumulative surface water impacts of these projects and the Malakoff EGS/Trinity Mine on their area of common influence (the Trinity River) should be very minor due to the large drainage area and magnitude of streamflows in the Trinity River.

Water Quality. While surface-water quality impacts on a given stream segment resulting from a series of point source and non-point source discharges may be considered cumulative, the effects of a particular discharge generally diminish downstream as a result of dilution and assimilation. Any point source discharges to Trinity River Segment 0804 or its tributaries will be subject to NPDES and TDWR permit requirements, including applicable effluent limitations for the types and sources of waste discharged. As the permit requirements are intended to protect water quality, and treatment measures will be implemented as necessary to comply with the requirements, adverse cumulative impacts on water quality resulting from the Malakoff EGS/Trinity Mine and other projects in the area are not anticipated.

5.7 WILDLIFE RESOURCES

5.7.1 Existing Environment

5.7.1.1 Wildlife Habitats and Species

Blair (1950) delineated seven biotic provinces in Texas based on the distribution of topographic features, climate, vegetation types and terrestrial vertebrates exclusive of birds. The Malakoff EGS/Trinity Mine site lies at the eastern edge of the Texan Biotic Province. This province represents a transitional area between the forested Austroriparian Province to the east and grassland provinces to the west (Blair, 1950). The integration of forests and grasslands on the site results in a mixture of vertebrate species typical of the two general habitats. This is a situation typical of the Texan Province, especially since the advent of agriculture in the area. The vertebrate fauna of the Texan Province in Texas consists of at least 49 species of mammals, 16 lizards, 2 land turtles, 39 snakes, 18 anurans (frogs and toads), and 5 urodeles (salamanders, newts, etc.) (Blair, 1950). This province supports no endemic vertebrate species. The Malakoff EGS/Trinity Mine site also occurs in a transitional vegetational area near the boundary of the Blackland Prairies and Post Oak Savannah Ecological regions of Texas (Gould, 1975). These two ecological regions together comprise approximately 8.1 million ha (20.0 million ac) in Texas.

The Malakoff EGS/Trinity Mine area can be divided into several major wildlife habitats that coincide with the major vegetational communities present. The major habitat division is between wooded and non-wooded areas. However, much of the site is of an ecotonal or transitional nature between these two habitat divisions. This results in an intermixing of forest-adapted species and prairie or grassland species. This is especially true of birds and the larger, more mobile mammals. The wooded areas contain some species that exist on the western limits of their range, while open, non-wooded areas contain some species not found farther east.

The distribution of habitats in the vicinity of the site and the activity patterns of many wildlife species result in some overlapping of faunal communities. Forest-dwelling species may occasionally occur in open areas around forest stands, and species particular to non-wooded habitats may occasionally be found in wooded areas. Edges or ecotones between major habitats are preferred by many wildlife species. This is true to some extent for recreationally important species such as the White-tailed Deer (*Odocoileus virginianus*), Eastern Cottontail (*Sylvilagus floridanus*), and Bobwhite (*Colinus virginianus*), as well as many songbirds. These transitional areas are preferred not only for the diversity of food materials available, but also for the usually dense cover provided through the characteristic overlapping of vegetational communities.

Four general wildlife habitat types occur in the project area. Brief characterizations of these major habitat types are provided below, along with lists of some characteristic faunal components.

Upland forest habitats comprise about 5,931.6 ha (14,657 ac) or about 25.4 percent of the power station and mine (ECI, 1982a). Post oak, winged elm, blackjack oak and eastern red cedar are the dominant overstory species, and American beautyberry, deciduous holly, redbud, southern blackhaw, smilax, poison ivy, huckleberry, and grape vine characterize the understory. A total of 12 mammal species was observed in upland forest during on-site surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Common mammals associated with this habitat are the White-tailed Deer, Fox Squirrel (*Sciurus niger*), Raccoon (*Procyon lotor*), Gray Fox (*Urocyon cinereoargenteus*), Eastern Cottontail, Opossum (*Didelphis virginiana*), Nine-banded Armadillo (*Dasypus novemcinctus*), and Eastern Wood Rat (*Neotoma floridana*). During on-site surveys, 70 species of birds were observed in upland forest (EH&A, 1978 and 1982b; NACCO, 1982b). Typical birds include the Northern Cardinal (*Cardinalis cardinalis*), Downy Woodpecker (*Picoides pubescens*), Carolina Chickadee (*Parus carolinensis*), Tufted Titmouse (*Parus bicolor*), Carolina Wren (*Thryothorus ludovicianus*), Northern Mockingbird (*Mimus polyglottos*), Red-shouldered Hawk (*Buteo lineatus*), and White-eyed Vireo (*Vireo griseus*). Estimated bird densities in the upland forested habitats of the mine site varied from 210/100 ha (210/247 ac) during the summer to 330/100 ha (330/247 ac) in the fall (EH&A, 1978). Estimated densities of birds at the power station site in upland forest/savannah were 366/100 ha (366/247 ac) during the spring (EH&A, 1982b). Twelve species of herpetofauna were observed in upland forest during on-site surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Amphibians and reptiles characteristic of this habitat include the Northern Fence Lizard (*Sceloporus undulatus*), Five-lined Skink (*Eumeces fasciatus*), Ground Skink (*Scincella lateralis*), and Texas Rat Snake (*Elaphe obsoleta*).

Bottomland forest habitats comprise about 2,149 ha (5,310 ac), or about 9.2 percent of the power station and mine site (ECI, 1982a). Water oak, green ash, Texas sugarberry, red mulberry, and black willow dominate the overstory, and smilax, deciduous holly, poison ivy, American beautyberry, buckbrush, buttonbush and Virginia creeper characterize the understory. A total of 12 mammal species was recorded from bottomland forest habitats (EH&A, 1978 and 1982b; NACCO, 1982b). Common mammals associated with this habitat are the White-tailed Deer, Fox Squirrel, White-footed Mouse (*Peromyscus leucopus*), Gray Fox, Bobcat (*Lynx rufus*), Swamp Rabbit (*Sylvilagus aquaticus*), Opossum, and Nine-banded Armadillo. Sixty-four avian species were observed in bottomland forest during on-site surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Typical bird species include the Carolina Wren, Carolina Chickadee, White-eyed Vireo, Indigo Bunting (*Passerina cyanae*), White-breasted Nuthatch (*Sitta carolinensis*), Downy Woodpecker, Red-bellied Woodpecker (*Melanerpes carolinus*), Northern Flicker (*Colaptes auratus*), Red-shouldered Hawk, and Barred Owl (*Strix varia*). Estimated bird densities in the bottomland forest habitats of the mine site varied from 511/100 ha (511/247 ac) in the summer to 513/100 ha (513/247 ac) in the fall (EH&A, 1978). During spring, bird densities at the power station site were estimated to be 210/100 ha (210/247 ac) in bottomland forest/savannah (EH&A, 1982b). During field surveys on site, 11 species of herpetofauna were recorded from bottomland forest habitat (EH&A, 1978 and 1982b; NACCO, 1982b). Amphibians and reptiles characteristic of this habitat include the Three-toed Box Turtle (*Terrapene carolina*), Green Anole (*Anolis carolinensis*), Southern Leopard Frog (*Rana sphenocephala*), Eastern Narrowmouth Toad (*Gastrophyrne carolinensis*), and Woodhouse's Toad (*Bufo woodhousei*).

Grassland, oldfield and pasture habitats comprise about 14,626.3 ha (36,146.1 ac), or about 62.7 percent of the power station and mine site (ECI, 1982a). Within this habitat type, trees are few in number or entirely absent, and the vegetation varies from stands of native or improved grasses to stands of weedy herbs and grasses. A total of 12 species of mammals were observed in this habitat type during field surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Common mammals associated with this habitat are the Eastern Cottontail, Hispid Cotton Rat (*Sigmodon hispidus*), Deer Mouse (*Peromyscus maniculatus*), Least Shrew (*Cryptotis parva*), and Plains Pocket Gopher (*Geomys bursarius*). Forty-eight species of birds were recorded from the grassland, oldfield and pasture habitat type during field surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Typical bird species include the Lark Sparrow (*Chondestes grammacus*), Eastern Meadowlark (*Sturnella magna*), Northern Mockingbird, Savannah Sparrow (*Passerculus sandwichensis*), Scissor-tailed Flycatcher (*Tyrannus forficata*), Mourning Dove (*Zenaida macroura*), Bobwhite, Red-tailed Hawk

(*Buteo jamaicensis*), and Turkey Vulture (*Cathartes aura*). Estimated bird densities in the grassland, oldfield and pasture habitats of the mine site range from about 100/100 ha (100/247 ac) in the summer to about 113/100 ha (113/247 ac) in the fall (EH&A, 1978). Twelve herpetofaunal species were observed in this habitat type during on-site surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Amphibians and reptiles characteristic of this habitat include the Woodhouse's Toad, Six-lined Racerunner (*Cnemidophorus sexlineatus*), Eastern Coachwhip (*Masticophis flagellum*), and Eastern Yellow-bellied Racer (*Coluber constrictor*).

Aquatic habitats are found in and immediately adjacent to the Trinity River, Wildcat Creek, Turkey Creek, other streams and their tributaries, and in numerous ponds and small lakes scattered throughout the project area. Marshes and similar hydric areas provide excellent feeding, roosting and nesting areas for wildlife, particularly migratory waterfowl. Several small marsh areas are scattered throughout the project area but most are subject to periodic drying during periods of low rainfall. Ponds, streams and rivers are not only important as habitat for resident wildlife, but as moisture resources for other species, particularly during extended dry periods. Migrating songbirds and waterfowl often congregate along watercourses during fall and spring. During on-site field surveys, three species of mammals were observed in this habitat type (EH&A, 1978 and 1982b; NACCO, 1982b). Common mammals associated with aquatic habitats and hydric communities include the Swamp Rabbit, Raccoon, Opossum and Nutria (*Myocastor coypus*). A total of 37 bird species was observed in association with aquatic habitats during field surveys on site (EH&A, 1978 and 1982b; NACCO, 1982b). Typical bird species include the Great Blue Heron (*Ardea herodius*), Killdeer (*Charadrius vociferus*), Little Blue Heron (*Egretta caerulea*), Green-backed Heron (*Butorides striatus*), Wood Duck (*Aix sponsa*), Green-winged Teal (*Anas crecca*), and American Coot (*Fulica americana*). Twenty-two species of herpetofauna were observed in aquatic habitats during on-site field surveys (EH&A, 1978 and 1982b; NACCO, 1982b). Hydric communities in the area support a diverse herpetofauna, including the Cottonmouth (*Agkistrodon piscivorus*), Blotched Water Snake (*Nerodia erythrogaster transversa*), Bullfrog (*Rana catesbeiana*), Blanchard's Cricket Frog (*Acris crepitans*), Southern Leopard Frog, Mississippi Mud Turtle (*Kinosternon subrubrum*), and Red-eared Slider (*Chrysemys scripta*).

The proposed makeup water pipeline corridor extends approximately 72 km (45 mi) from the Neches River in eastern Anderson County to the power station site. The proposed corridor was investigated by EH&A personnel on June 16-17, 1982. The proposed route was reconnoitered by a single-engine airplane and road crossings were investigated by automobile. The vegetation, soils and land use of the proposed corridor have been mapped and are published in a separate document (EH&A, 1982c). Wildlife habitats in the proposed makeup water pipeline corridor are by-in-large similar to the power station/mine site. Approximately 26.6 percent of the proposed pipeline corridor occurs in upland forest and 62.4 percent in grassland (EH&A, 1982c). However, approximately 19.3 percent of the proposed corridor occurs in pine and mixed pine-hardwood forest. These wildlife habitats do not occur in the power station/mine project area. The most common wildlife species found in various habitat types on the power station/mine site are also likely to be the most common species found along the proposed pipeline corridor. However, some species that are more habitat specific to pine forest may occur along the proposed pipeline corridor and not within the power station/mine site.

The proposed transmission line corridor extends approximately 3.7 km (2.3 mi) north of the proposed power station site boundary. The wildlife habitats found along this proposed corridor include pasture/cropland, upland forest and bottomland forest.

5.7.1.2 Important Species

"Important species" are defined as those that are: 1) commercially or recreationally valuable; 2) threatened or endangered; 3) critical to the survival of a species satisfying criterion 1) or 2); or 4) critical to the structure or function of the ecosystem, or biological indicators. No species present on site are judged to satisfy criterion 3) or 4). Species potentially found on site that are considered to be threatened or endangered are discussed in Sec. 5.10.

Commercially and Recreationally Valuable Species. Several species of mammals and birds are recreationally hunted in the Malakoff EGS/Trinity Mine Project area, and several species of furbearing mammal are trapped commercially. These wildlife species are therefore considered valuable recreational and commercial resources.

The White-tailed Deer is the most numerous and important big game mammal in the state (Davis, 1974). Deer hunting in Texas is an ever popular sport, appealling to a wide variety of sportsmen. During on-site ecological surveys, deer tracks were most often found in forested areas, especially bottomland forests along watercourses. Deer populations in the Post Oak Savannah and Blackland Prairie ecological areas of Texas tend to be lower than other ecological areas of the State. Texas Parks and Wildlife Department (TPWD) data for the year 1981 indicate a population of about 24,409 White-tailed Deer in Anderson County (49.3 deer/405 ha (49.3 deer/1,000 ac) in acceptable habitat) and a population of 9,461 deer in Henderson County (30.8 deer/405 ha (30.8 deer/1,000 ac) in acceptable habitat) (Harwell and Gore, 1982).

The Bobwhite is an important gamebird over much of the eastern two-thirds of Texas. Preferred food items found in the project area include Croton sp., Panicum sp., ragweed, oak mast, partridge pea, Paspalum sp., and American beautyberry (Lay, 1969). Habitat preferences of the Bobwhite include low, dense, woody and herbaceous vegetation used for cover, and open areas and edges which provide both grasses and herbs for food. Road census data from the mining prospect area indicate approximately 0.35 Bobwhite/km (0.56/mi) observed during the summer and 0.25 Bobwhite/km (0.40/mi) observed during the fall (EH&A, 1978). A road cruise census conducted during the spring of 1981 at the power station site revealed approximately 1.86 Bobwhite/km (3.0/mi) (EH&A, 1982b). Recent TPWD data indicate that Bobwhite numbers in the Blackland Prairies and Post Oak Savannah ecological areas comprise only 5.7 and 3.3 percent, respectively, of the statewide population (Gore, 1978a). Although exact density numbers are not known, it is probable that Bobwhite numbers throughout the project site are comparatively low, with moderate numbers being found in small areas where past management of this species has occurred (EH&A, 1982b).

The Mourning Dove is the most widespread and abundant game bird in Texas, preferring semi-open and cultivated fields. Nesting usually occurs in woody vegetation while feeding occurs in open terrain (Grue, 1977). Seeds comprise nearly 100 percent of the Mourning Dove's diet. The average relative densities of Mourning Dove as determined from call count surveys conducted from 1966-1981 in the Blackland Prairies and Post Oak Savannah are 16.6 and 21.1, respectively, per 24.1 km (15 mi) call count transect. During the same statistical period the statewide average count was 20.1 per 24.1 km (15 mi) call count transect (George, 1981). Road census data from the mine site indicated 0.90 Mourning Doves/km (1.45/mi) during summer and 2.74/km (4.41/mi) during fall (EH&A, 1978). Road census data from the power station site revealed 0.75 Mourning Doves/km (1.20/mi) during spring (EH&A, 1982b).

The Wild Turkey (Meleagris gallopavo) is an important game bird in certain areas of the Post Oak Savannah. No turkeys were observed on the power station/mine site during the surveys and no density estimates are available for the project area. Eastern/Rio Grande hybrid Turkeys have been released by the TPWD in the Hairgrove area of Henderson County and in the Engeling Wildlife Management Area in Anderson County (Gore, 1978b). It is unlikely that any of these transplanted Turkeys would wander far enough from their release locations to inhabit the project site. However, suitable habitat does exist in the project area and it is possible that Turkeys occur there.

Fox Squirrels and Eastern Gray Squirrels (Sciurus carolinensis) are important small game mammals over much of the eastern half of the state. Fox Squirrels were observed commonly during surveys of the project site. Gray Squirrels were observed during a recent survey (NACCO, 1982b), and potential habitat appeared to exist along portions of streams and rivers within the project area. Recent squirrel densities derived from time-area counts in the Engeling Wildlife Management Area are as follows: upland -- Fox Squirrel 0.07/ha (0.17/ac), Gray Squirrel 0/ha (0/ac), total = 0.07 squirrels/ha (0.17/ac); bottomland -- Fox Squirrel 0.11/ha (0.27/ac), Gray Squirrel 0.47/ha (1.16/ac), total = 0.58 squirrels/ha (1.43/ac) (Veteto, 1978). These densities should approximate those of the project area.

The Black-tailed Jackrabbit (Lepus californicus), Eastern Cottontail and Swamp Rabbit, although not strictly defined as game animals, are hunted throughout Texas. Jackrabbits prefer open, short-grass vegetation. Eastern cottontails occur in a variety of habitats including open areas and woodlands although they tend to be most abundant along edges which supply an abundance of both food and cover. Swamp Rabbits frequent moist, poorly drained bottomlands as well as marshes. The Black-tailed Jackrabbit, Eastern Cottontail and Swamp Rabbit were observed during wildlife surveys of the project area. The densities of these species within the project area are unknown.

Furbearers such as the Raccoon, Nutria, Coyote (Canis latrans), Beaver (Castor canadensis), Gray Fox, Red Fox (Vulpes fulva), Bobcat, and Mink (Mustela vison) are of some economic and recreational importance in Texas. The Raccoon and Opossum appear to be the most common furbearers in the project area and are most abundant in wooded lands, especially along watercourses. With the exception of the Raccoon, a very low percentage of any species of furbearing animals is harvested from the Post Oak Savannah ecological region of Texas. Beaver signs were observed at several locations during the surveys. The project area probably supports decreasing numbers of Beaver due to trapping activities. According to local sources, Beaver have been almost entirely trapped out of the project area in the last few years.

Waterfowl hunting is a popular recreational pursuit in Texas. It is estimated that the Blackland Prairies/Cross Timbers and Prairies and Post Oak Savannah regions accounted for 17.4 and 9.8 percent, respectively, of the 1.16 million ducks harvested in Texas during the 1979-1980 hunting season (Stutzenbaker, 1981). Farm ponds, small lakes and creeks present in the project area undoubtedly provide habitat for some migrating and over-wintering waterfowl, although the total areal extent of such open water habitats is only 0.99 percent of the total project area (ECI, 1982a).

5.7.1.3 Ecologically Sensitive Habitats

In general, an area may be considered sensitive from a wildlife standpoint if it 1) supports a rare animal community, 2) supports an endangered or threatened species, or 3) is highly productive wildlife habitat (e.g., wetland). Habitats on the project site meeting these criteria are wetlands and bottomland forests. Both of these are considered highly productive wildlife habitat. No wildlife habitats identified on or adjacent to the project area are unusual or unique to the project area or ecological region. All are locally well represented outside the site. Bottomland forests comprise approximately 9.2 percent of the project site (ECI, 1982a). The USCE has determine that there are 1,440.5 ha (3,560 ac) of regulatory wetlands within the project area (see Appendix D).

5.7.2 Impacts of No Action Alternative

Project area land would likely remain under the same land use practices as presently exist, with local changes occurring as determined by the local landowners.

5.7.3 Impacts of Project Alternatives

5.7.3.1 Impacts of Construction

Power Station. The major impacts to wildlife which will result from construction of the power station will be removal of habitat by clearing. Increased noise and activity levels may also affect wildlife around the perimeter of the power station site, displacing animals from the site. Approximately 426.4 ha (1,066 ac) of land will be utilized for power station construction (164 ha (400 ac) generating station and 215 ha (525 ac) material handling area). The remainder of the area to be disturbed, approximately 58 ha (141 ac), will be affected by construction of ancillary facilities. The remainder is not currently expected to be physically disturbed. The power station site consists primarily of pasture (58.6 percent), bottomland forest (23.3 percent) and upland forest (15.9 percent). Animals of lesser mobility and size will suffer direct elimination by actions of clearing machinery (bulldozers, earthmovers, etc). Larger, more mobile animals will relocate to surrounding, undisturbed habitat. Some smaller animals, being temporarily deprived of habitat cover, will be subject to increased natural predation. The influx of additional animals into the surrounding habitat will temporarily increase local population densities in these adjacent habitats. However, population levels should return to near preconstruction levels as animals diffuse further into the surrounding habitat and encounter increased competition and the mechanisms which determine carrying capacity of the habitat. The result will be a net loss of some individuals as a result of direct impacts of clearing and construction. Habitat preemption for the power station facilities must be considered a long-term, adverse impact, with respect to wildlife.

Construction of the intake structure, makeup water pipeline and transmission lines associated with the power station will result in short-term, adverse impacts due to habitat modification. Construction of the 72-km (45-mi) makeup water pipeline will involve a 45.7-m (150-ft) wide right-of-way. However, only a 12.2-m (40-ft) wide right-of-way will be maintained for operation of the pipeline. The 45.7-m (150-ft) construction right-of-way will include a total of approximately 332 ha (820 ac) including 207 ha (512 ac) of pasture, 88 ha (218 ac) of upland forest, and 18 ha (45 ac) of bottomland forest. The 12.2-m (40-ft) wide right-of-way to be maintained for the makeup water pipeline will include a total of approximately 88.5 ha (219 ac) including 55 ha (137 ac) of pasture, 24 ha (58 ac) of upland forest, and 5 ha (12 ac) of bottomland forest. The preferred electric transmission line route will be a total of approximately 3.7 km (2.3 mi) in length and will include a 91.4-m (300-ft) wide right-of-way. The preferred electric transmission line will include a total of approximately 33 ha (81 ac) including 20.4 ha (50.4 ac) of pasture, 9.7 ha (20 ac) of bottomland forest, and 2.2 ha (5.5 ac) of upland forest. Loss of habitat during clearing of the rights-of-way will displace wildlife into the surrounding areas. Within the pipeline and transmission line rights-of-way, habitat will return to a grassland type. Where rights-of-way pass through forest, species diversity may locally increase due to the newly created habitat diversity and edge effect. Construction through open fields should have little permanent affect on wildlife. Overall, construction of the makeup water pipeline and electric transmission line is expected to result in minor, long-term, adverse impact to local wildlife.

Mine. Minor, adverse impacts to wildlife will occur during construction of mine support facilities such as operations buildings, access and haul roads, stream diversions, levees, and dragline or bucket wheel erection sites. Existing vegetation/wildlife habitat will be removed and wildlife will either be displaced or destroyed. Total land requirements for mine support facilities will be 84 ha (205 ac).

The displacement of mobile wildlife into adjacent areas will temporarily increase local wildlife population densities. However, the adjacent habitats are at or near their normal carrying capacities. Population stresses due to increased densities will activate density-dependent population regulating mechanisms that will push local populations toward their normal pre-project levels resulting in a loss of some individuals. This impact will be long term, extending over the life (35 years) of the facilities. With proper reclamation, these areas can be restored to their approximate premining biological productivity following decommissioning and dismantling of the facilities.

Increased noise and activity around support facilities will also displace some wildlife species into adjacent, unaffected habitat. Increased levels of dust may adversely affect nearby wildlife, although only in restricted areas downwind from the source. Larger, more mobile species can avoid these areas, but smaller less mobile species may decrease in very localized areas due to direct effects on function or decreases in food availability due to lower levels of primary production.

5.7.3.2 Impacts of Operation

Power Station. Impacts to wildlife resulting from operations of the power station will be minimal. Noise and activity will be disturbances to wildlife living around the power station periphery. Some species densities in the immediate area may decrease due to this, while other species may be attracted to the resultant habitat edge or ecotone which develops at the station periphery. Some wildlife species demonstrate a tolerance to human activity and development, and will shortly adapt to the proximal nature of the power station. Some areas of the power station site will be revegetated to grassland habitat, thus providing habitat which will partially mitigate the construction phase losses. Station emissions will be controlled according to State and Federal regulations and should have no effect on wildlife.

Operation of the makeup water pipeline and electric transmission facilities should produce no major adverse impacts on local wildlife. Natural revegetation of the rights-of-way will enhance the value of the area for numerous wildlife species that favor edge situations. Maintenance of clear (non-wooded) corridors will sustain early successional, highly productive plant communities that are valuable as sources of food and shelter for many animal species. Maintenance requiring the movement of trucks or other machinery along the rights-of-way may cause some local disturbance producing short-term impacts. However, no significant long-term, adverse impacts to terrestrial wildlife should accrue from operation of the makeup water pipeline and electric transmission line.

Mine. Operation of the mine will create the greatest direct adverse impacts to wildlife during the life of the project. Complete habitat removal and alteration of the natural parameters under which the ecosystem is in balance will be a result of the mining process. These extreme manipulations of the habitat will result in short-term elimination of all wildlife in active mining areas, followed by a slow revitalization of some of the wildlife resources as habitat is re-established during the postmining period. Approximately 250.5 ha (611 ac) will be mined per year with a total estimated mine area of 8,774 ha (21,400 ac) being mined over the life of the project. During the actual mining process, increments of approximately 410 ha (1,000 ac) will be disturbed at any one time by land clearing, overburden removal, lignite extraction and reclamation. The total mine site contains approximately 5,762 ha (14,054 ac) of upland forests, 14,129 ha (34,461 ac) of pastures/croplands and 1,854 ha (4,523 ac) of bottomland forests. The vegetation/wildlife habitats to actually be impacted by mining operations over the life of the project include 4.461 ha (10,880 ac) of upland forest, 10,484 ha (25,570 ac) of pastureland/cropland, and 1,005 ha (2,450 ac) of bottomland forest.

To the extent possible using the best technology currently available, NACCO is required to minimize disturbances and adverse impacts of the activities on fish, wildlife and related environmental values, and achieve enhancement of such resources where practicable (Section 390, Texas Coal Mining Regulations, 1981). Reclamation efforts will result in restoration of soil characteristics suitable for re-establishment of vegetation according to specific regulations. Land contours and drainage patterns will be restored to pre-project conditions in most areas. Some type of vegetative cover will be established on all reclaimed areas.

Land clearing will result in habitat removal as described in Sec. 5.7.3.1. From the time of clearing to re-establishment of ground cover, mining areas will essentially be totally absent of wildlife due to the complete removal of habitat. Wildlife species will either be displaced to surrounding unaffected habitat or be destroyed by mining machinery. Local population densities of wildlife in the unaffected peripheral habitat will temporarily increase due to the sudden influx of displaced animals. Assuming this habitat is at or near its carrying capacity, natural regulating mechanisms will return wildlife densities to premining levels. Clearing activities will also disturb surrounding fauna with increased human activity and noise. Stress on various animal populations near the mine resulting from overcrowding and nearby mining activities may cause decreased reproductive success and increased mortality, both of which are natural population regulating mechanisms. These adverse effects will be localized and temporary, ameliorating as mining moves on and reclamation progresses.

Wetland and bottomland hardwood forest habitats, followed by upland forest, are the most valuable wildlife habitats in the project area. Mining activities will directly or indirectly impact bottomland hardwood forests in the Trinity River flood plain and several tributaries. Impacts of bottomland hardwood forest clearing include habitat removal, increased erosion leading to further habitat degradation, and reduction of detrital contributions to the aquatic system.

Section 390(a) of the Texas Coal Mining Regulations requires:

> Each person who conducts surface mining activities shall establish on all affected land a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of disturbed land or species that supports the approved postmining land use . . .

Variances are available to allow introduced species if approved by the Commission. For this reason and because of historic demands by landowners to request managed pasture as a postmining land use, EPA has chosen to evaluate two postmining revegetation alternatives. The first scenario is conversion to 100 percent managed pasture, typically coastal bermudagrass. The second scenario involves a return to premining vegetative cover which includes: 65.7 percent pasture/cropland, 28.0 percent upland forest and 6.3 percent bottomland forest.

Under the first scenario (conversion to 100 percent managed pastureland) overall wildlife species diversity would decrease due to the lack of habitat heterogeneity. This would result in a long-term, significant, adverse impact to wildlife. Common species most adversely affected by conversion of forest habitats to pasture would include: White-tailed Deer, Fox Squirrel, Raccoon, Gray Fox, Bobcat, Eastern Wood Rat, several species of woodpeckers, Red-shouldered Hawk, Barred Owl, Three-toed Box Turtle, Green Anole, Ground Skink and Texas Rat Snake. Common species beneficially impacted from such conversion would include: Eastern Cottontail, Hispid Cotton Rat, Deer Mouse, Plains Pocket Gopher, Lark Sparrow, Eastern Meadowlark, Savannah Sparrow, Scissor-tailed Flycatcher and Bobwhite. The net result of the lack of diverse wildlife habitat is considered to be a significant, long-term, adverse impact.

Under the second scenario (return of premining vegetative cover) the impact to wildlife species would be less severe, although significant, short-term, adverse impacts would still occur. By the end of the bond period, assumed to be approximately 10 years following initial reclamation efforts, the 65.7 percent of the site to be disturbed by mining activities which is currently in pasture/cropland would probably support similar densities and diversity of wildlife species to those presently occurring in this habitat type on the site.

On the remaining 34.3 percent of the site where restoration of hardwoods occurs, several decades will be required for successional growth of woody vegetation and establishment of a forest community. Thus, wildlife usage of reclaimed forest will undergo a parallel succession starting with animals common to field and pasture and climaxing to forest community species.

Several ponds in the project area provide valuable wetland habitat for waterfowl and other water dependent species. After obtaining approval from the SCS, two small Soil Conservation Service floodwater retarding structures will be drained and mined during the course of the project, thus reducing the total amount of aquatic habitat in the area. These structures will be replaced during the reclamation phase. Several more ponds and small lakes in the project area will be avoided. However, the habitat value of these aquatic habitats and wildlife usage of them will likely decrease due to increased nearby human activity, increased sedimentation from runoff, and potential dewatering during mining. These impacts should be short-term and minor, but adverse in nature. Mitigative measures will be implemented to reduce effects of downstream sedimentation, e.g., sedimentation ponds. The mine plan also calls for avoidance of major portions of Prairie and Wildcat creeks and associated riparian habitat. Further discussion of wetlands is found in Sec. 5.11.

5.7.3.3 Combined

Construction and operation of Malakoff EGS/Trinity Mine project will impact the majority of upland forest, pasture, cropland, bottomland forest and aquatic habitats within the 23,320-ha (57,600-ac) project area. Of this amount, only 10.2 percent will be bottomland forest or aquatic habitats (ECI, 1982a). However, actual disturbance in the mine area will be staged over a 35-year period. Some of the area will be totally reclaimed and released from bond long before the end of the project. During the life of the project, significant portions of the project area will be under direct impact of mining and construction activity, resulting in an overall loss of wildlife due to habitat destruction. Reclamation efforts will result in rapid replacement of pasture habitat but forest restoration will only occur after many years. Approximately 50 percent of the Malakoff EGS/Trinity Mine Project area currently exists as improved pasture (ECI, 1982a). Under a worst-case scenario, most of the upland mine areas and much of the bottomland forest habitat will be reclaimed and maintained as pasture, resulting in a large decrease in forest habitat in the project area. The effect of the project will be an overall reduction in wildlife density and diversity in the project area. Under the other reclamation scenario, the approximate current acreages of forest in the project area will be returned using native tree species. Although it will probably take several decades for individual trees to reach the stage of maturity of trees presently on site, trees will be planted as mining progresses, and thus will be spread out over the life of the project. By the end of the project, trees in the first areas reclaimed will be fairly mature, and the overall appearance of reclaimed areas will be a gradient from the earliest to most recent. Ecological succession ". . . is an orderly process of community development that involves changes in species structure and community processes with time; it is reasonably directional and, therefore, predictable" (Odum, 1971). As succession on the reclaimed areas proceeds through various developmental stages toward a climax community, wildlife species diversity within these areas will undergo corresponding change. During early developmental stages, wildlife species diversity will be low, but will increase as the community reaches the more mature successional stages (Odum, 1971). The effect of the project under this scenario will be an initial overall reduction in the density and diversity of wildlife species. However, as succession of the reclaimed forest areas advances, the diversity of wildlife species will increase. The wildlife diversity and carrying capacities of the reclaimed forest areas should approach those which currently exist in forests on site, as the reclaimed forests reach a similar successional stage to existing forests. The combined effects of construction and operation of the mine and generating station should not exceed the sum of their separate effects.

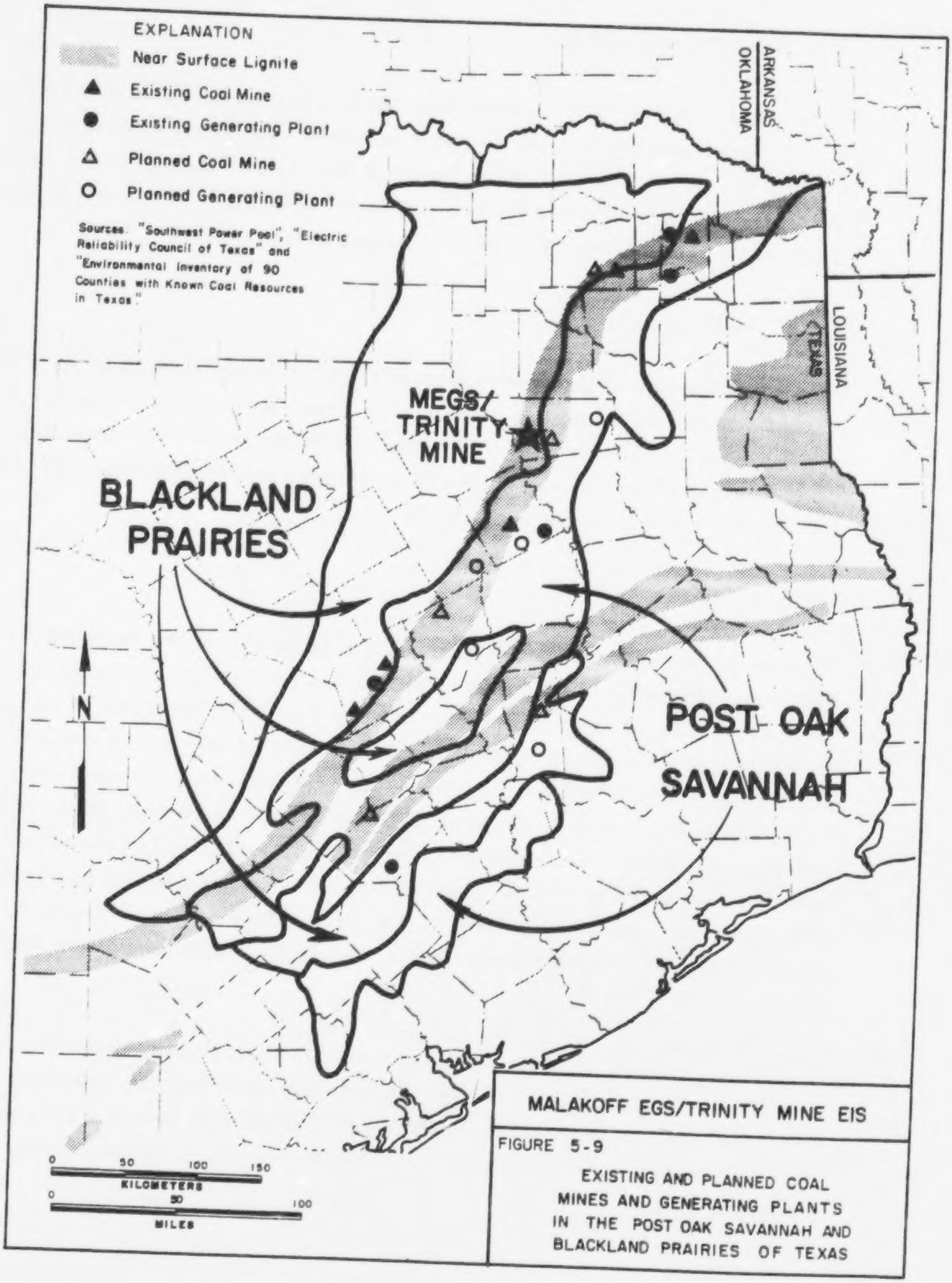
5.7.3.4 Cumulative

The proposed project occurs near the boundary of the Blackland Prairies and Post Oak Savannah ecological areas of Texas (Gould, 1975). The Blackland Prairies in Texas contains approximately 4.7 million ha (11.5 million ac), while the Post Oak Savannah encompasses about 3.4 million ha (8.5 million ac) (Gould, 1975). The two areas combined contain approximately 8.1 million ha (20 million ac).

Figure 5-9 shows the existing and planned coal mines and generating plants within these ecological areas of Texas, along with the location of near-surface lignite. There is an estimated 4.75 million ha (11.7 million ac) of near-surface lignite in Texas (Kaiser et al., 1980). General estimates place the near-surface lignite in the Blackland Prairies at 288,500 ha (712,500 ac) and 769,200 ha (1.9 million ac) within the Post Oak Savannah. The extent of the near-surface lignite covers about 6 percent of the total Blackland Prairies Ecological Area, and about 22 percent of the total Post Oak Savannah Ecological Area. These percentage estimates represent the "worst-case" should all of the near-surface lignite be mined within these ecological areas.

By taking an average of 8,097 ha (20,000 ac) for each existing and planned mine/generating station indicated on Fig. 5-9, including the proposed project, all projects within the Blackland Prairies comprise about 1.0 percent of the total ecological area. Assuming the same average project size, the combined projects within the Post Oak Savannah comprise about 1.2 percent of the total ecological area.

Generally, each mining area includes some good quality wildlife habitat, especially along waterways and in bottomlands. The cumulative impacts of these projects include the loss of various wildlife habitat types during mining, and more importantly, the possibility that many of the more sensitive habitat types (e.g., marshes, swamps, bogs, etc.), cannot or may not be fully re-established after reclamation. Currently, there are no known data to indicate the extent of sensitive wildlife habitats in the mining regions of Texas or to determine at what threshold the destruction of these productive habitats would become significant to wildlife. Therefore, these potential, cumulative adverse impacts constitute an irretrievable commitment of these important natural resources. Also, landowner preference usually dictates the ultimate land-use type after mining, and the trend appears to be conversion to improved pasture. A long-term, cumulative effect of this trend would be a long-term, significant, adverse impact on wildlife habitat.


EXPLANATION
▨ Near Surface Lignite
▲ Existing Coal Mine
● Existing Generating Plant
△ Planned Coal Mine
○ Planned Generating Plant
Sources: "Southwest Power Pool", "Electric Reliability Council of Texas" and "Environmental Inventory of 90 Counties with Known Coal Resources in Texas."
OKLAHOMA
ARKANSAS
TEXAS
LOUISIANA
MEGS/ TRINITY MINE
BLACKLAND PRAIRIES
POST OAK SAVANNAH
N
0 50 100 150
KILOMETERS
0 50 100
MILES

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-9

EXISTING AND PLANNED COAL MINES AND GENERATING PLANTS IN THE POST OAK SAVANNAH AND BLACKLAND PRAIRIES OF TEXAS

5.8 AQUATIC RESOURCES

The following discussion is based primarily on baseline studies conducted during 1981 and 1982 by Houston Lighting & Power Company personnel. The results of these studies are contained in two reports: 1) Baseline Survey of the Aquatic Ecology of the Malakoff Electric Generating Station and Pipeline Route; and 2) Baseline Survey of the Aquatic Ecology of the Trinity Lignite Mine Site, both issued in June, 1982.

5.8.1 Existing Environment

The aquatic resources of the power station and contiguous mine sites, together with the proposed makeup water pipeline, consist of a small segment of the Neches River, numerous small streams in both the Neches and Trinity river watersheds, and small impoundments, both perched and located on intermittent stream channels, which range in size from less than 0.41 ha (1 ac) to 16 ha (39 ac).

5.8.1.1 Aquatic Habitat

The proposed makeup water intake structure is to be located on the Neches River about 38 river-km (24 river-mi) below Lake Palestine. The river at this location is 15 to 20 m (50 to 65 ft) wide with a maximum depth of about 2 m (7 ft). River flow at this point is negligible since the proposed intake location is within the backwater of an existing low-water dam. Habitats are relatively restricted here with substrata types confined to unconsolidated silty material, leaf litter and large amounts of woody debris. Macrophyte growth at this location appears to be discouraged due to shading by riparian vegetation combined with a lack of shallow water habitat. The Neches River water is relatively clear, and exhibits moderate conductivity and dissolved solids content. The pH is slightly alkaline, and dissolved oxygen levels were above 7 mg/l during both April and September, 1981.

Five large, permanent streams, Cedar Creek, Walnut Creek, Turkey Creek, Prarie Creek and Wildcat Creek, together with their tributaries, lie within the boundaries of the contiguous mine and power station sites. All of these streams lie within the drainage of the Trinity River. Aquatic sampling was conducted on Cedar, Walnut, Turkey, Wildcat and Beaver creeks.

These streams are of moderate size with widths typically less than 10 m (33 ft) and depths less than 1 m (3.3 ft), except where log jams at bridges and culverts have created larger pools, and in the upper reaches of Cedar Creek just below Cedar Creek Reservoir. All of these streams are characterized by fine grained substrata (sand-silt-clay) and show only a small amount of riffle development. The streams flow through a mosaic of woodland, brush and cleared pasture and consequently experience varying degrees of shading and input of terrestrial organic material. Although some aquatic macrophyte stands are present in cleared areas, they are not generally extensive except where marsh areas have developed as a result of the interruption of streamflow by dikes and levees on the Trinity River flood plain. The presence of organic material, either as anaerobic muds in pools, or as leaf litter and woody debris, is common in all these streams.

The streams of the area all possess low gradients and are consequently slow moving and tend to be relatively clear. Conductivity and total dissolved solids concentrations are moderate to high in these streams and pH's are consistently in the slightly alkaline range. Nutrient levels (ammonia, nitrate, total phosphate) tend to be high in all streams, but considerable variability exists among stations and seasons.

Along the proposed makeup water pipeline corridor, representative stream crossings were sampled on Catfish, Wolf and Mine creeks in the Trinity River drainage, and on Walnut (different from the Walnut Creek mentioned above) and White Oak creeks in the Neches River drainage.

These streams are similar in physical characteristics to the streams of the mine-power plant site except that they tend to flow through more wooded areas, and thus are more generally shaded and carry a somewhat greater detrital load. Conductivity and total dissolved solid content of these streams are lower than those discussed above, pH tends to be around neutral, and water staining by humic materials is more common.

Pond habitats are not uncommon in the project area. They range from small, perched impoundments (stock ponds) to moderate sized reservoirs on creek channels. These impoundments are characteristically shallow, although some of the channel reservoirs may have depths exceeding 4 m (13 ft), with silt clay bottoms and often with appreciable loadings of organic matter. The larger impoundments that have extensive shallows exhibit stands of emergent vegetation, but submerged aquatic macrophytes are not widespread since most of these ponds tend to be relatively turbid.

5.8.1.2 Aquatic Biota

Phytoplankton assemblages are most often dominated by green algae and diatoms, but the other major algae groups are also locally important. Among these are Euglenophytes Cryptophytes and bluegreen algae, the latter having been observed in bloom proportions in both stream and pond habitats. Both diversity and abundance tend to be high in area waters where sufficient light is available. In general, the predominent phytoplankton taxa are those typical of littoral or pond habitats, and often found in waters having high nutrient levels. Assemblages that could be considered truely planktonic were noted in the Neches River, Cedar Creek immediately downstream of Cedar Creek Reservoir, and in two large impoundments on the mine site, Hall and Thornton lakes (SCS flood retarding structures #1 and #3, respectively).

Zooplankton populations are much less abundant in the stream habitats than in the ponds, although diversity and composition are roughly similar. All the zooplankton assemblages were dominated by crustaceans, primarily Cladocera and Cyclopoid copepods. It is likely that the use of a finer mesh zooplankton net would have shown that the stream habitats actually possessed rotifer dominated zooplankton assemblages.

The aquatic habitats of the project area are heavily dominated by tubificids and chironomid larvae. These invertebrates are often regarded as indicators of enrichment and low oxygen concentrations. They are also typical of fine grained substrates and often dominate woodland streams having large accumulations of terrestrial detritus. A wide variety of other macroinvertebrate taxa are also present, though in lower numbers and with more scattered distributions. In many cases, these taxa are reflective of the presence of silty substrates (e.g., Hexagenia and Caenis) or are typically detritus feeders (e.g., Amphipods, Palaemonetes and Elmid beetles).

The fish fauna of the mine/power plant site and the makeup water pipeline corridor was dominated by centrarchids, minnows and topminnows. Predictably for creek habitats, most individuals were small. Larger game and rough fish including bass, catfish and carp are undoubtedly present in some of the pond habitats and in the Neches River, but the only large specimens taken were Longnose Gar and Smallmouth Buffalo from the Neches River.

5.8.1.3 Important Species

"Important Species" are defined as those that are: 1) commercially or recreationally valuable; 2) threatened or endangered; 3) critical to the survival of a species satisfying criterion 1) or 2); or 4) critical to the structure or function of the ecosystem, or biological indicators. No species present on site are judged to satisfy criterion 3) or 4). Those that satisfy criterion 1) are discussed below, while threatened or endangered species are addressed in Sec 5.10.

Recreationally or Commercially Important Species. Several species belonging to the families Ictaluridae (catfish) and Centrarchidae (bass and sunfish) are common in the waters of the project area. While these are important sportfish species, the project site creeks are too small to support significant recreational fishing and the ponds are privately owned and without public access. Due to the proximity of Lake Palestine and a number of other reservoirs, sportfishing in the immediate vicinity of the proposed makeup water intake on the Neches River is considered light.

In addition to catfish, smallmouth buffalo (Ictiobus bubalus) and river carpsucker (Carpiodes carpio) are considered commercially valuable species. However, no commercial fishing is currently permitted in either Anderson or Henderson counties.

5.8.2 Impacts of No Action Alternative

The effects of the aquatic systems of the project area resulting from selection of the no action alternative are unpredictable. One result could be no change from present conditions, but alteration of land use or population density in the area could have substantial impacts.

5.8.3 Impacts of Project Alternatives

5.8.3.1 Impacts of Construction

Power Station. Construction activities potentially affecting the aquatic environment will include vegetation clearing and site preparation for construction of station facilities including buildings, access roads, lignite storage pile, and makeup water, ash, wastewater treatment and runoff retention ponds. In addition, construction activities will include the placement of a concrete intake structure on the west bank of the Neches River and the laying of approximately 72.4 km (45 mi) of 0.9-m (36-in.) concrete pipeline.

The proposed power station facilities, including the materials handling area, will occupy approximately 426.5 ha (1,066 ac), and will avoid the channels of Beaver, Cedar and Walnut creeks. Clearing of existing vegetation will result in limited erosion and sedimentation in Beaver, Cedar and Walnut creeks. Potential adverse impacts to these streams may include: temporarily reduced phytoplankton, zooplankton, benthos and fish populations; a temporary reduction in benthic habitat diversity; a temporary increase in stream nutrient levels; and temporarily reduced biological productivity. Since the aquatic communities of the project area presently tolerate fine grained substrates and high turbidities during rainfall runoff, potential temporary and localized effects such as these are not expected to result in adverse impacts to the resident fauna.

The amount and intensity of rainfall during construction will, to a great extent, determine the magnitude of impact. However, erosion control procedures are planned to minimize adverse aquatic ecosystem impacts associated with construction activities. Any potential impacts previously described which are realized will be of short-term duration, primarily restricted to the construction and immediate post-construction phase of the project.

The small stock ponds on the power station site will likely be eliminated, but no net loss of pond habitat is anticipated since a 15.4-ha (38-ac) raw water storage pond will be constructed at the terminus of the makeup water pipeline.

Impacts to aquatic ecosystems associated with construction of the proposed makeup water system may include temporary erosion and sedimentation in the immediate vicinity of the intake structure and the pipeline stream crossings. Potential adverse impacts to stream systems resulting from sedimentation may include: temporary reductions in the diversity and abundance of aquatic populations, temporary increases in stream nutrient levels; and temporarily reduced primary productivity. Temporary and localized sedimentation is not expected to result in adverse impacts to area streams since these streams are characterized by low zooplankton populations, benthic invertebrate populations adapted to soft, muddy substrates, and fish communities dominated by species tolerant of turbid environments. The duration of any potential impacts would be short term and restricted to the duration of construction activities at the intake location and the stream crossings. Moreover, erosion control measures will be implemented to reduce potential adverse impacts.

Mine. Except for the construction of permanent structures such as administrative and maintenance buildings, and lignite handling facilities, activities normally considered construction will be ongoing throughout the life of the mine and, thus, are defined as operation activities. Defined construction activities include land clearing and site preparation for construction of haulroads, dragline erection sites and erosion and sedimentation control structures. Construction activities associated with the mine are not expected to significantly impact the aquatic environments of the project site.

5.8.3.2 Impacts of Operation

Power Station. Impacts to aquatic environments from operation of the power station will result from the off-site discharge of liquid wastes and the operation of the makeup water intake and pipeline. Although the waste streams, including cooling tower and boiler blowdown, runoff from storage, maintenance and materials handling areas, metal cleaning and sanitary wastes, will be recycled within the plant to a large extent, some discharge will be necessary.

Impacts associated with operation of the makeup water system may result from right-of-way maintenance and intake of water from the Neches River for the makeup water pipeline. Maintenance of the pipeline will require that woody vegegation be restricted from colonizing within the right-of-way. Therefore, long-term but localized impacts to aquatic ecosystems by the right-of-way clearing will include localized elevated temperatures, increased solar insolation, and increased phytoplankton production at stream crossings. Rooted aquatic plants may also become established in areas where canopy cover is permanently removed.

The intake structure will be located on the west bank of the Neches River 0.64 km (0.4 mi) upstream of an existing low water dam to ensure that sufficient water will be available for operation. Intake screening will be removable trash racks having 61-cm (2-ft) by 8.6-cm (3 3/8-in.) openings. Maximum intake velocity at the trash racks will be 15.2 cm/sec (0.5 ft/sec). No antifouling chemicals will be used at the site. The intake opening will be extended through the depth of the water column and will be located flush with the bank. EPA has determined that the intake structure meets the guidelines contained in "Development Document for Best Technology Available for the Location, Design, Construction and Capacity of Cooling Water Intake Structures for Minimizing Adverse Environmental Impact" (EPA, 1976).

Mine. During mining, disruption of normal volumes and patterns of flow may be expected until reclamation has been completed, with adverse impacts on aquatic species proportional to the amount of channel and drainage area affected.

Except for Wildcat Creek, all the streams traversing the mine site will be disrupted by mining. Reclamation plans call for restoration of the channels to their approximate longitudinal profile and cross section. Riparian vegetation and environmentally acceptable stream gradients will be established to provide stable, non-eroding stream channels. These channels will contribute to postmining re-establishment of the biota and habitats temporarily disrupted by the mine operations. This will result in the temporary loss of the habitats and biota of the existing channels. Although the new channels can be expected to be rapidly colonized, they are unlikely to have the habitat diversity of the natural channels for several years. Those stream segments now having a woody riparian cover will, until that type of vegetation is replaced, be considerably changed in character. The decrease in shading would encourage the growth of algae and aquatic macrophytes while resulting in a decrease in the loading of the stream with terrestrial organic matter. Thus, the food base of the community would shift from terrestrial detritus to in situ production. While extensive alterations in the abundance and composition of the algal and macrophyte flora can be expected, the effects on other components of the aquatic community are less clear.

Zooplankton and littoral macroinvertebrate densities could rise due to increases in phytoplankton food availability and the additional cover provided by more extensive stands of aquatic vegetation. The factors affecting potential changes in the macroinvertebrate community are more complex. Although in situ production will to a large degree supplement terrestrial organic material at the base of the food chain, it must be pointed out that the largest proportion of aquatic macrophyte production also enters the food web as detrital material, rather than being cropped when living. Deposit feeding organisms (e.g., most oligochaetes) may be largely unaffected, as the source of organic material in the sediments appears to be unimportant relative to the amount available. Some changes may occur in the composition of the detritus feeding fauna as the source of detritus changes from (mainly) terrestrial plant leaves to aquatic vegetation, but too little is known about the dependence (or lack thereof) of these species on specific detrital sources. Two groups of macroinvertebrates, the scrapers/algal grazers and the filter feeders can be expected to increase in abundance and diversity in response to these changes. Additionally, the increased habitat diversity provided by macrophyte stands can be expected to result in some increase in macroinvertebrate abundance and diversity. Fish species feeding on macroinvertebrates (e.g., sunfishes, catfish) would be affected by changes in invertebrate species composition and distribution only insofar as the availability, or catchability, of prey items changed. For instance, the greater abundance and variety of invertebrates generally associated with aquatic vegetation may result in some increases in sunfish and topminnow populations.

Other factors attendant to the change from woodland to open stream habitat that may affect the fish community include increases in the ranges of variation in temperature and water level, and increased availability of cover in stands of vegetation.

Although the changes in stream communities in response to removal of forest cover can be extensive and long term, there is little basis on which to judge whether the impacts will be adverse or beneficial. Much of the area to be mined is cleared pasture or cropland, and stream segments traversing these areas would not be greatly changed, assuming channel reconstruction did not result in straightened reaches or deep, narrow channels unable to develop premining levels of habitat diversity.

Increases in suspended solids can be expected in the runoff from areas in which vegetation clearing, road building or other construction activities take place. This potential impact is to be controlled by diverting runoff water around disturbed areas and by the use of sediment filters and sedimentation ponds for the runoff from those areas. Sedimentation pond releases will conform to applicable State and Federal regulations (maximum allowable total suspended solids, 70 mg/l).

The severity of impacts due to increased suspended solids loads is dependent on the concentration of suspended material, the amount of sedimentation which takes place, and the nature of the substrate and biota receiving the sediment. Fish may leave areas of high suspended solids concentration, but will return when conditions are favorable. Given the sediment control measures to be used, and the present, relatively high turbidity of area waters, direct impacts to fish populations from increased suspended solids loads are not expected to be significant.

Of greater potential significance is substrate blanketing by sediment and destruction of aquatic vegetation and invertebrates. However, use of sediment control structures will present massive blanketing of stream beds, and the fine-grained nature (sand, silt and clay) of the substrates in the project area ensures that no long-term alteration of substrate type will result if sedimentation rates are temporarily increased during construction activities. In addition, area streams are presently dominated by a benthic invertebrate fauna characteristic of fine-grained substrates. Therefore, any adverse impacts resulting from increased suspended solids loads are expected to be short term and localized, as long as sediment control structures are properly designed and operated.

When forest land is cleared, concentrations of inorganic nutrients in runoff can temporarily increase by substantial amounts. Although the phenomenon is temporary, increases in aquatic macrophyte and algal growth can occur in reaches receiving sufficient sunlight.

Adverse impacts to aquatic communities could occur if mine operation resulted in alterations in hydrologic regimes such that flood peaks were increased and dry periods prolonged. The requirements for stream channel reconstruction, and revegetation of disturbed areas, incorporated into the mine plan, are intended to prevent this potential impact.

Additional constituents of runoff from roads and service areas will be oil and grease deposited during operation of vehicles. Runoff from service areas and road surfaces will be controlled by sedimentation ponds.

5.9 VEGETATION

This section presents baseline information concerning the vegetation within the Malakoff EGS/Trinity Mine Project area, including the Malakoff EGS/Trinity Mine site, the Malakoff to Trinidad-Forest Grove (MTFG) transmission lines, and makeup water pipeline. Information concerning threatened and endangered species and regulatory wetlands is presented separately in Secs. 5.10 and 5.11, respectively.

Six separate baseline reports survey the vegetation within specific portions of the Malakoff EGS/Trinity Mine Project area. Though the vegetation of the Malakoff EGS/Trinity Mine site, as presently bounded, is described in ECI (1982a and 1982b), the vegetation in the majority of the Malakoff EGS and Trinity Mine sites is additionally described in two earlier reports (EH&A, 1982b and 1978, respectively). The vegetation found along the makeup water pipeline and the MTGF transmission lines is described by EH&A (1982c and 1982d, respectively).

5.9.1 Existing Environment

The Malakoff EGS/Trinity Mine Project area is located in southwestern Henderson County and northern Anderson County, Texas. Portions of three of the vegetational areas described by Gould (1975) are included in the area covered by the complex. The Malakoff EGS/Trinity Mine site, MTFG transmission lines, and the westernmost portion of the makeup water pipeline are situated in the ecotone between two vegetational regions, the Blackland Prairies to the west and the Post Oak Savannah to the east. The eastern portion of the makeup water pipeline extends into the western portion of the Pineywoods vegetational area described by Gould (1975).

The Post Oak Savannah vegetational area consists of gently rolling to hilly uplands dissected by flat bottomlands. In the uplands, the relatively open overstory of the Post Oak Savannah is characteristically dominated by post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*), with a dense understory of tall grasses. The upland climax grasses include little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum avenaceum*), switchgrass (*Panicum virgatum*), purpletop (*Tridens flavus*), silver bluestem (*Bothriochloa saccharoides*), Texas wintergrass (*Stipa leucotricha*), and *Chasmanthium sessiliflorum* (Gould, 1975). Bottomland forests in the region have a relatively dense overstory dominated by a variety of oaks (*Quercus* spp.), elms (*Ulmus* spp.), and hickories (*Carya* spp.). Much of the region has been heavily impacted by grazing or converted to cropland or tame pasture. There also is evidence that tree and shrub densities in this area have increased tremendously relative to the virgin condition (Gould, 1975). In native grazing land, the climax grasses have been mostly replaced by invading plants such as red lovegrass (*Eragrostis oxylepis*), broomsedge bluestem (*Andropogon virginicus*), splitbeard bluestem (*Andropogon ternarius*), yankeeweed (*Eupatorium compositifolium*), bullnettle (*Cnidoscolus texanus*), greenbriar (*Smilax* spp.), yaupon (*Ilex vomitoria*), smutgrass (*Sporobolus indicus*), and western ragweed (*Ambrosia psilostachya*). Non-native grasses and legumes introduced for tame pastures have replaced many native grass species. The most important introduced species includes bermudagrass (*Cynodon dactylon*), bahiagrass (*Paspalum notatum*), dallisgrass (*Paspalum dilatatum*), vaseygrass (*Paspalum urvillei*), and bush clovers (*Lespedeza* spp.) (Gould, 1975).

Topography of the Blackland Prairie vegetational area is gently rolling to nearly level and well dissected with rapid surface drainage. The climax grasses of the Blackland Prairies area are generally the same as those of the Post Oak Savannah area. Little bluestem is the major climax dominant. Other important grasses are big bluestem (Andropogon gerardi), Indiangrass, switchgrass, sideoats grama (Bouteloua curtipendula), hairy grama (Bouteloua hirsuta), tall dropseed (Sporobolus asper), silver bluestem and Texas wintergrass. Under heavy grazing, Texas wintergrass, buffalograss (Buchloe dactyloides), Texas grama (Bouteloua rigidiseta), smutgrass and many annuals increase or invade. Post oak and blackjack oak also increase under heavy grazing (Gould, 1975). Because of its high fertility, much of the Blackland Prairies area has been brought under cultivation (Correll and Johnston, 1970).

The Pineywoods vegetational area is characterized by gently rolling to hilly land. This vegetational area occurs only in the eastern portion of the makeup water pipeline corridor portion of the project. Numerous streams feeding into several large rivers are important features of this area. Therefore, wetland areas are numerous, relative to the two previously discussed vegetational areas, but not extensive. Commercial timber species, predominantly loblolly pine (Pinus taeda) and shortleaf pine (P. echinata), are important. Hardwoods such as oaks, hickories and maples (Acer spp.) are also common. Many of the grasses, native legumes and shrubs mentioned above in the Post Oak Savannah and Blackland Prairie areas also occur as forage plants and invader species in the native and improved pasturelands which are interspersed throughout the Pineywoods area (Gould, 1975).

5.9.1.1 Vegetational Communities

The areal extent of each of the vegetational communities within the Malakoff EGS/Trinity Mine site, makeup water pipeline right-of-way, and MTFG transmission line right-of-way is given in Tables 5-24, 5-25 and 5-26, respectively. Of the approximately 23,683 ha (58,519 ac) associated with the Malakoff EGS/Trinity Mine site, MTFG transmission lines right-of-way, and makeup water pipeline right-of-way, 8,208.5 ha (20,283.2 ac) is forested land. Approximately 6,031.7 ha (14,904.3 ac) of the forested land occur in the uplands (including 9.6 ha (23.7 ac) pine forest/plantation in the pipeline right-of-way) and 2,176.8 ha (5,378.9 ac) in the bottomlands. The remaining 21,506.2 ha (38,235.8 ac) is composed of regeneration/cutover areas, grassland/pastureland (including hayfields), croplands and orchards, aquatic habitats (open water), hydric communities, urban areas and disturbed areas (spoil/pits). Acreages and percentages of vegetation types for the mine and power plant are adapted from ECI (1982b). Figure 5-10 shows the location of various vegetation type within the Malakoff EGS/Trinity Mine boundaries.

TABLE 5-24
VEGETATION/LAND COVER TYPES OF THE MALAKOFF EGS/TRINITY MINE PROJECT AREA

Type	Subtype	Total Acres[a]	Percent of Area
Forest			
Upland	Juniper	65.1	0.11
	Deciduous, oak-dominated	14,591.9	25.33
Bottomland	Deciduous, oak-dominated	850.9	1.48
	Deciduous, elm-dominated	671.6	1.17
	Deciduous, oak and elm mixed	3,787.6	6.57
Pasture	Native	7,370.2	12.79
	Improved	28,775.9	49.95
Cropland	No subdivisions	297.6	0.52
Orchard	No subdivisions	40.4	0.07
Urban	No subdivisions	187.1	0.32
Open water	No subdivisions	569.5	0.99
Spoil/Pits	No subdivisions	406.4	0.71
Totals		57,614.2	100.01

a. For metric unit equivalents, please refer to metric conversion table in the Glossary.

Source: ECI, 1982a.

TABLE 5-25
AREAL EXTENT OF VEGETATION TYPES WITHIN THE PROPOSED MAKEUP WATER PIPELINE

Vegetation Type	Inside Malakoff EGS/Trinity Mine Boundary						
	12.2 m (40 ft) ROW[a]		33.5 m (110 ft) Easement[b]		45.7 m (150 ft) ROW[c]		Percent of Total
	ha	ac	ha	ac	ha	ac	
Aquatic habitat	0.1	0.2	0.2	0.5	0.3	0.7	1.3
Bottomland forest	0.2	0.4	0.4	1.0	0.6	1.4	2.5
Grassland	5.6	13.8	15.3	37.9	20.9	51.6	87.9
Pine forest/ plantation	---	---	---	---	---	---	---
Regeneration	---	---	---	---	---	---	---
Upland forest	0.3	0.7	0.8	2.0	1.1	2.8	4.5
Hydric communities	0.2	0.6	0.6	1.5	0.9	2.1	3.8
TOTALS (Inside Boundary)	6.4	15.7	17.3	42.9	23.8	58.6	100.0

TABLE 5-25 (Cont'd)

Vegetation Type	Outside Malakoff EGS/Trinity Mine Boundary						Percent of Total
	12.2 m (40 ft) ROW[a]		33.5 m (110 ft) Easement[b]		45.7 m (150 ft) ROW[c]		
	ha	ac	ha	ac	ha	ac	
Aquatic habitat	0.7	1.8	2.0	4.9	2.7	6.6	0.9
Bottomland forest	4.7	11.5	12.8	31.7	17.5	43.3	5.7
Grassland	49.7	122.8	136.6	337.6	186.3	460.3	60.4
Pine forest/ plantation	2.6	6.3	7.0	17.4	9.6	23.7	3.1
Regeneration	0.8	1.9	2.1	5.1	2.8	7.0	0.9
Upland forest	23.2	57.4	63.9	157.9	87.1	215.3	28.3
Hydric communities	0.6	1.5	1.7	4.1	2.3	5.6	0.7
TOTALS (Outside Boundary)	82.3	203.2	226.1	558.7	308.3	761.8	100.0

TABLE 5-25 (Concluded)

Vegetation Type	Total						
	12.2 m (40 ft) ROW[a]		33.5 m (110 ft) Easement[b]		45.7 m (150 ft) ROW[c]		Percent of Total
	ha	ac	ha	ac	ha	ac	
Aquatic habitat	0.8	2.0	2.2	5.4	3.0	7.4	0.9
Bottomland forest	4.8	11.9	13.3	32.8	18.1	44.7	5.4
Grassland	55.2	136.5	151.9	375.4	207.2	512.0	62.4
Pine forest/ plantation	2.6	6.3	7.0	17.4	9.6	23.7	2.9
Regeneration	0.8	1.9	2.1	5.1	2.8	7.0	0.9
Upland forest	23.5	58.2	64.7	160.0	88.3	218.1	26.6
Hydric communities	0.8	2.1	2.3	5.6	3.1	7.7	0.9
TOTALS (Overall)	88.5	218.9	243.5	601.7	332.1	820.6	100.0

a. Operation right-of-way (ROW).

b. Temporary construction easement.

c. Combined operation and construction ROWs.

Source: EH&A, 1982c.

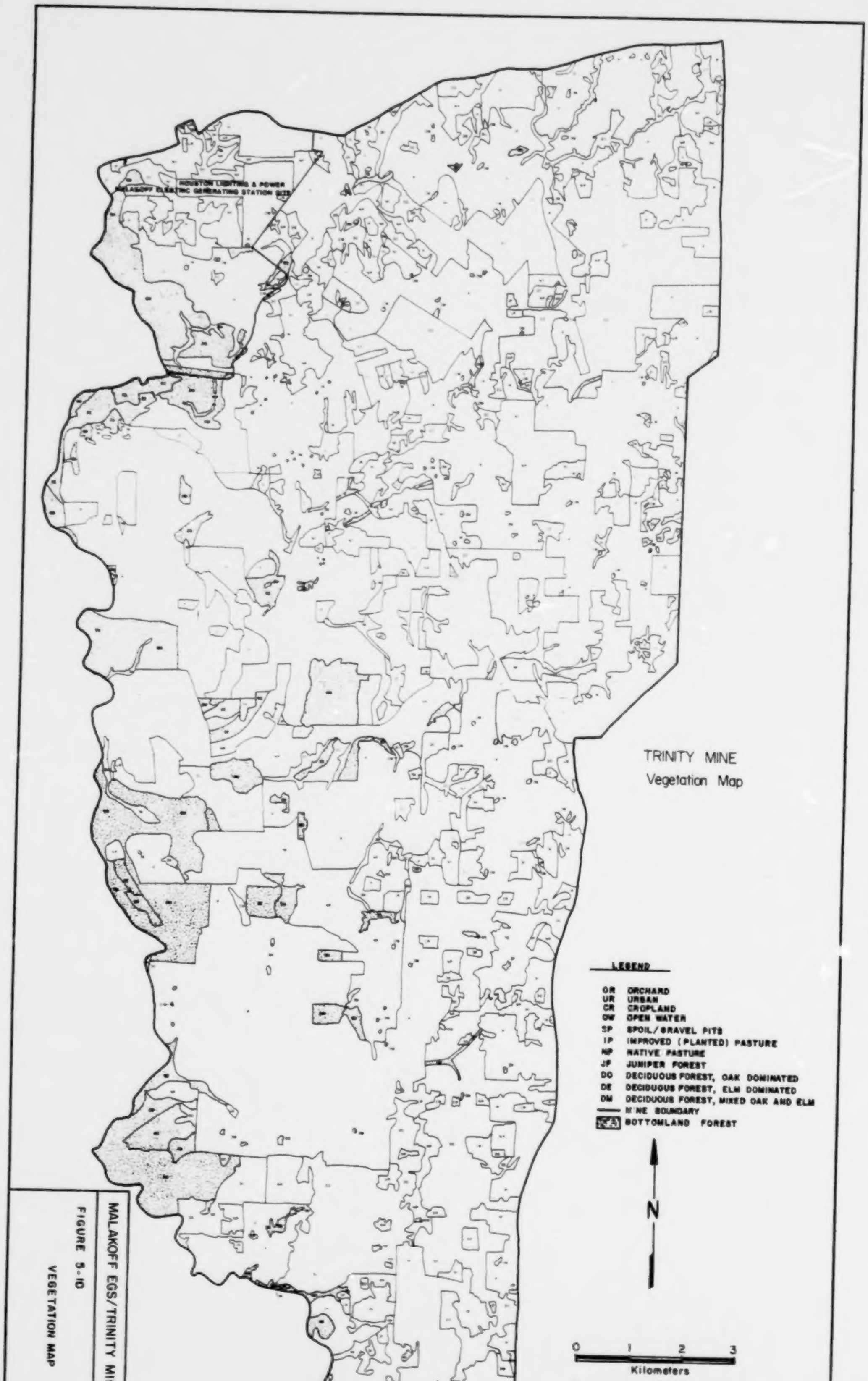
TABLE 5-26
AREAL EXTENT OF VEGETATION TYPES WITHIN THE 91.4 M (300 FT) RIGHT-OF-WAY OF THE PROPOSED MALAKOFF TO TRINIDAD-FOREST GROVE TRANSMISSION LINES[a]

Vegetation Type[b]	Outside Malakoff EGS Boundary		Inside Malakoff EGS Boundary		Total		
	ha	ac	ha	ac	ha	ac	%
Grassland (including hayfields)	13.8	34.0	6.7	16.5	20.4	50.4	61.9
Bottomland forest	6.1	15.1	3.6	9.0	9.7	24.1	29.6
Upland forest	1.7	4.1	0.5	1.3	2.2	5.5	6.8
Aquatic habitat	0.6	1.4	0	0	0.6	1.4	1.7
TOTAL	22.2	54.6	10.8	26.8	32.9	81.4	100.0

a. Preferred route.

b. Croplands, hydric communities and regeneration/cutover areas did not occur within the surveyed right-of-way.

Source: EH&A, 1982c.


HOUSTON LIGHTING & POWER
MALAKOFF ELECTRIC GENERATING STATION SITE
TRINITY MINE
Vegetation Map
LEGEND
OR ORCHARD
UR URBAN
CR CROPLAND
OW OPEN WATER
SP SPOIL/GRAVEL PITS
IP IMPROVED (PLANTED) PASTURE
NP NATIVE PASTURE
JP JUNIPER FOREST
DO DECIDUOUS FOREST, OAK DOMINATED
DE DECIDUOUS FOREST, ELM DOMINATED
DM DECIDUOUS FOREST, MIXED OAK AND ELM
MINE BOUNDARY
BOTTOMLAND FOREST
N
0 1 2 3
Kilometers
0 1 2
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-10

VEGETATION MAP

SOURCE: ECI, 1982a

Areal extent data for the pipeline right-of-way and the transmission line right-of-way are taken from EH&A (1982c, 1982d, respectively).

Upland Forest. The upland forest community in the project area consists primarily of oak/hickory dominated forest. Forests which occur in the well-drained uplands on ridge tops and upper slopes contain abundant post oak and blackjack oak, with occasional southern red oak (Quercus falcata), Shumard red oak (Quercus shumardii), hickories, elms and eastern redcedar (Juniperus virginiana). The forests in uplands which are on less well-drained soils usually contain relatively more willow oak (Quercus phellos), water oak (Quercus nigra) and sugarberry (Celtis laevigata). Eastern redcedar occurs in scattered clumps as a relatively common invader species of the upland forests. Upland pine/hardwood forests characteristic of the Pineywoods within the eastern portion of the pipeline right-of-way are composed primarily of shortleaf pine and loblolly pine mixed with the hardwood species mentioned above.

Although considerable sunlight penetrates the relatively open canopy in upland forests, the understory is generally kept down by the browsing of livestock and deer. In some areas, however, the understory is quite dense. The most common species in the understory are yaupon, farkleberry (Vaccinium arboreum), American beautyberry (Callicarpa americana), southern blackhaw (Viburnum rufidulum), winged sumac (Rhus copallina), smooth sumac (R. glabra), coralberry (Symphoricarpos orbiculatus), deciduous holly (Ilex decidua), parsley hawthorn (Crataegus marshallii), and St. Andrew's cross (Ascyrum hypericoides). Common woody vines include greenbriar, poison ivy (Rhus toxicodendron), Virginia creeper (Parthenocissus quinquefolia) and grape vines (Vitis spp). Beneath openings in the overstory, the understory consists primarily of young tree saplings. Common herbaceous species are little bluestem, purpletop, Indiangrass, sedges (Carex spp.), bullnettle, sandbur (Cenchrus sp.), various species of Paspalum, and Chasmanthium sessiliflorum (EH&A, 1978).

Pine Forest/Plantation. The pine forests/plantations, composed of loblolly and/or shortleaf pine, occur exclusively in the easternmost portion of the pipeline corridor, within the Pineywoods vegetational region (EH&A, 1982b). In some areas, hardwoods have been selectively cleared, resulting in the uneven-aged pine forest type within this category. Pine plantations are tree farms, composed of even-aged pines. The pine forest type is more common along the pipeline corridor than are pine plantations. Understory vegetation is usually sparse or absent in both types of managed pine stands often as a result of silvicultural practices such as periodic controlled burning.

Regeneration/Cutover Areas. Regeneration/cutover areas are delineated only within the makeup water pipeline (EH&A, 1982b). This category occurs in areas that have been clear-cut or selectively cut for timber-harvesting or other purposes within the past several years. Such areas are presently undergoing secondary succession and are dominated by pine and/or hardwood seedlings and saplings up to approximately 6 to 9 m (20 to 30 ft) in height. With silvicultural management (i.e., selective cutting of hardwoods), many of these regeneration/cutover areas should become even-aged pine stands. In other cases, these areas are planted in pine monocultures soon after timber harvesting.

Bottomland Forest. Bottomland forest in the Malakoff EGS/Trinity Mine Project area consists primarily of well-defined flood plains associated with large streams and rivers at elevations generally below 82 m (270 ft) above sea level. In addition, bottomland forest occupies flood plains dissecting the uplands at higher elevations. Despite the similarities in species composition, a number of distinctions can be drawn between upland and bottomland forests in the project area. The chief differences are the lesser importance of post oak in bottomland stands and the presence of certain conspicuous overstory species in the bottomland forest which do not usually occur in the uplands. Among the latter are bur oak (*Quercus macrocarpa*), boxelder (*Acer negundo*), overcup oak (*Quercus lyrata*), pecan (*Carya illinoiensis*), black willow and sycamore (*Plantanus occidentalis*). Dominance in bottomland stands is usually shared by a variety of species including water oak, willow oak, Texas sugarberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), pecan, red mulberry (*Morus rubra*), Shumard red oak (*Quercus shumardii*), American elm (*Ulmus americana*) and cedar elm (*Ulmus crassifolia*) (EH&A, 1978 and 1982a).

The understory of the bottomland hardwood forests is generally composed of saplings of the overstory species, along with sassafras (*Sassafras albidum*), deciduous holly, American beautyberry, yaupon and coralberry in the shrub layer. Poison ivy, greenbriar, rattan vine (*Berchemia scandens*), trumpet creeper (*Campsis radicans*), grape, moonseed vine (*Cocculus carolinus*), peppervine (*Ampelopsis arborea*) and Virginia creeper are among the most common vines. Herbaceous species include wildrye (*Elymus virginicus*), *Chasmanthium sessiliflorum*, *Chasmanthium latifolium*, *Ruellia* spp., Canada garlic (*Allium canadense*), sedges (*Carex* spp.), violets (*Viola* spp.) and wood-sorrel (*Oxalis* sp.).

Grassland/Pastureland. Grasslands in the study area are composed of both native and improved pastures, as well as hayfields. Improved pastures and hayfields in the study area are managed by sprigging or sowing various grasses, legumes and other forage plants and by either regular mowing or managed cattle grazing (although some areas are obviously overgrazed). Improved pastures and hayfields occur generally on level areas, relatively free of brush. Two of the most important grasses on the improved pasture are common and coastal bermudagrass. Other grasses presently planted as a monoculture, or as a mixture, are lovegrass (*Eragrostis* spp.), bahiagrass (*Paspalum notatum*), wildrye (*Elymus* spp.), fescue (*Vulpia* spp.), and millet (*Panicum texanum*). Among other grasses used less frequently are dallisgrass, barley (*Hordeum* spp.), and oats (*Avena fatua*). In many instances, a species of legume such as Dutch white clover (*Trifolium repens*), bush clover or vetch (*Vicia* spp.) are mixed with the grasses (ECI, 1982a).

The majority of the pastures designated as "native" (ECI, 1982a) are oldfields which were once cleared for cultivation, but are being managed such that they are now undergoing secondary succession. In some stands of otherwise native grassland, bermudagrass is the predominant species and the native species are minor components (EH&A, 1978). Native forbs and grasses and various invader species now dominate these pastures, which are typically used for cattle grazing. Such species include high value forage plants such as yellow Indiangrass (*Sorghastrum avenaceum*), little bluestem, dropseed (*Sporobolus* spp.), sedges (*Carex* spp.), longspike tridens (*Tridens strictus*), and low grazing value plants such as windmillgrass (*Chloris verticillata*), western ragweed, crotons (*Croton* spp.), tumblegrass (*Schedonnardus paniculatus*), and many other annual grasses, weeds and woody plants. Scattered frequently throughout the native grassland are small trees and shrubs, particularly post oak, sugarberry, common persimmon (*Diospyros virginiana*), eastern redcedar, blackjack oak and coma (*Bumelia lanuginosa*).

Cropland and Orchards. The most commonly cultivated crops in the study area are corn and watermelons. The cropland category also includes small domestic gardens, where these were distinguishable on the photography used for vegetation mapping. Orchards in the project area are typically managed pecan tree groves (ECI, 1982a). Croplands along the pipeline right-of-way were not distinguished from the grassland vegetation type because lack of access to the land prevented ground-truthing, and cropland is practically indistinguishable from hayfields on aerial photography. Since the majority of the pipeline right-of-way occurs in uplands, where croplands are not abundant, the extent of croplands in the right-of-way is believed to be minimal.

Aquatic Habitat. Aquatic habitats consist of open water areas not dominated by vegetation. Woody vegetation typically occurring along the margins of ponds and streams include black willow, river birch (Betula nigra), overcup oak, water-elm (Planera aquatica), red maple and sugarberry. Additional species include common buttonbush (Cephalanthus occidentalis), giant cane (Arundinaria gigantea), wax-myrtle (Myrica spp.), sea-myrtle (Baccharis halimifolia), and such herbaceous species as bequilla (Sesbania macrocarpa), water smartweeds (Persicaria spp.), purple pluchea (Pluchea purpurascens), arrowhead (Sagittaria latifolia), lady's thumb (Persicaria vulgaris), rice cutgrass (Leersia oryzoides), Juncus spp., climbing hempweed (Mikania scandens), cattail (Typha sp.), water primrose (Ludwigia sp.), and occasional small patches of floating water fern (Azolla sp.) and duckweed (Lemna spp.) (EH&A, 1978).

Hydric Communities. Hydric communities were delineated in the Malakoff EGS/Trinity Mine site in a separate report (ECI, 1982b). Hydric communities were delineated in separate reports covering a portion of the Malakoff EGS site and the entire length of the makeup water pipeline (EH&A, 1982c and 1982d).

Delineated hydric communities generally include swamps and marshes. Swamp and marsh communities occur adjacent to rivers, streams and lakes in the pipeline right-of-way. Characteristic vegetation in the swamp forests consists of green ash, overcup oak, water hickory (Carya aquatica), black willow, and sycamore with water-elm in the understory. Marshes occur in the margins of ponds, streams and lakes as well as in poorly-drained depressions adjacent to aquatic habitats. Typical species include common buttonbush, cattails, sedges (Carex spp. and Cyperus spp.), soft rush (Juncus effusus var. solutus), spikerush (Eleocharis sp.), smartweed, arrowhead and water primrose.

In addition to the delineated hydric communities (i.e., swamps and marshes), a third type of hydric community, hillside seepage bogs, occurs in the project area. Bog communities are generally too small to be delineated on vegetation maps. Nonetheless, bogs are important habitats because they support relatively more uncommon plant species than other habitats. In addition, bogs are ecologically sensitive because of their dependence on a continuous water supply. Bogs occur in wooded areas at the base of slopes and in draws where seepage water maintains continuously saturated soil conditions. Herb species comprising the more or less distinctive flora of the bogs include peat mosses, yellow fringed orchid (Habenaria ciliaris), southern twayblade (Listera australis), violet (Viola primulifolia), and others. Uncommon herb species associated with bogs include monkey flower (Mimulus sp.), burmannia (Burmannia sp.), green adder's mouth (Malaxis unifolia), three birds orchid (Triphora trianthophora), Texas trillium (Trillium texanum), and green rein-orchid (Habenaria clavellata). Dominant tree species in bogs include sweet-gum, blackgum, American holly (Ilex opaca), red maple, and American hornbeam; whereas dominant shrubs include possum-haw (Viburnum nudum), viburnum (Viburnum sp.), tassel-white (Itea virginica) and azalea (Rhododendron sp.).

Urban Areas. Urban areas are only mapped as a vegetation category within the Malakoff EGS/Trinity Mine site (ECI, 1982a). The category primarily includes extensions of the communities of Malakoff and Cross Roads, along with relatively large farmstead complexes within the mine site. All such areas contain numerous buildings, planted trees and manicured yards or gardens.

Spoil/Pits and Disturbed Areas. This vegetation category also is mapped only within the Malakoff EGS/Trinity Mine site (ECI, 1982a). The category includes unvegetated areas, including gravel operations that are still active, plus older gravel pits that are naturally revegetating. Also included are cleared areas used for sludge pits and other operations for the oil and gas developments in the mine property.

5.9.1.2 Important Plant Species

"Important" species are herein defined as those that: 1) are commercially or recreationally valuable; 2) are threatened or endangered; 3) affect the well-being of some important species within criterion 1) or 2); or 4) are critical to the structure and function of the ecological system or are biological indicators. Threatened and endangered species are discussed in Sec. 5.10.

Commercially important plant species in the project area include crops (corn, watermelon, pecan) and species utilized as forage by livestock which are described in the appropriate vegetational community descriptions above. In addition, marketable oaks and pines are of commercial significance. The economic value of these commercially important plant species is discussed in Sec. 5.22.

Plant species important as browse or forage materials for wildlife in the project area qualify as important species under three different criteria: 1), 2) and 4). Browse and forage plants include Japanese honeysuckle, rattan vine, dewberry and blackberry (Rubus spp.), hawthorn, willow oak, farkleberry, post oak, St. Andrew's cross, American beautyberry, trumpet-creeper, deciduous holly, yaupon and greenbriar. Of special importance to deer is oak mast (Alexander, 1976; Lowery, 1974).

The importance of the project area in terms of wildlife habitat varies from one plant community to another. Pine plantations, which occur only along the easternmost portion of the makeup water pipeline, offer little in the way of plant species or structural diversities. Few browse or forage species occur in the understory to support deer and other wildlife. The structural homogeneity of the overstory of pine plantations limits the number of habitats available for bird species.

Upland oak/hickory/pine stands within the project site offer the most diversity in understory and overstory plant species in terms of available wildlife food and structural characteristics. The greater structural and species diversity in upland forests provide habitat for a correspondingly greater number of wildlife species.

The understory in mature bottomland hardwood stands is usually quite shady and, hence, depauperate in forage and browse plants. The overstory is structurally diverse, however, and a relatively large number of bird species occur there. In immature or disturbed bottomland stands, herbs, shrubs and saplings are usually abundant and offer a variety of food sources for wildlife. The same is true of the edges of most forested stands. The increased availability of light near the forest edge permits the growth of not only grassland species, but also a number of herb and shrub species that do not thrive in the shade of a closed, forested stand.

Grasslands within the project site are mainly coastal bermudagrass and bahiagrass improved pastures. Such pastures lack the diversity required for good wildlife habitat, but are used sporadically for forage. Native pastures and oldfields, however, do provide good wildlife cover, especially for birds and small mammals.

Dominant species are, by definition, critical to the structure and function of the ecological system and, therefore, qualify as important species under criterion 4). The dominant species in the project site include a number of woody and herbaceous species, as discussed previously. Removal of these species from the project area would alter the structure and productivity of the ecosystem.

5.9.1.3 Ecologically Sensitive Areas

In general, an area may be considered ecologically sensitive if: 1) it supports a rare plant or animal community or a rare, endangered or threatened species; 2) it is a highly productive habitat having substantial commercial or recreational value; and/or 3) it supports species considered to be wetland indicators by a regulatory agency (e.g., USCE). Federally listed threatened and endangered plant species are discussed in Sec. 5.10. Regulatory wetlands and their importance as ecologically sensitive areas are discussed in Sec. 5.11.

No plant communities within the project area are unique to the area. Similar vegetation occurs in the area contiguous to the project site as well as throughout northeastern Texas. Little, if any, of the vegetation of the project area is undisturbed. Most of the original forest has been converted to pastureland or cropland, while nearly all of the existing forest has been subjected to selective logging or clear-cutting in the past.

Highly productive habitats within the project area, which qualify as ecologically sensitive areas, include bottomland forest and hydric communities and are discussed in Sec. 5.9.1.1. Bogs are especially sensitive due to the rare plant species they contain.

5.9.2 Impacts of No Action Alternative

In the absence of the project, changes in the terrestrial vegetation could be expected if current trends continue. The TPWD has stated that vegetation cover is changing drastically in East Texas due to man's activities (Lay, 1969). In many portions of the lignite belt, both upland and bottomland forest and shrub communities are being converted either to pastureland or row croplands. Plant successional patterns are being complicated by the introduction of grasses and legumes for improved pastures (Gould, 1975). In the eastern portion of the makeup water pipeline, natural hardwood forests are selectively cut to promote commercial pine forests, or are cleared and replanted with pure stands of pine. These changes to terrestrial vegetation generally result in reduced plant species diversity and less native, natural vegetation.

5.9.3 Impacts of Project Alternatives

5.9.3.1 Impacts of Construction

Power Station. Impacts of construction associated with the power station include those occurring within the station site and along the two major transportive systems lying outside the station site: the makeup water pipeline and the MTFG transmission lines.

Station Site. Plant site construction will impact local biological communities by the removal of vegetation. About 426.4 ha (1,066 ac) of vegetation, primarily pastureland, will be preempted by construction of the proposed power station and associated facilities within the station site.

Construction within the station site boundary will be performed in such a manner as to minimize adverse impacts on the vegetational communities adjacent to and downstream from the station site. Primary production in vegetation immediately adjacent to construction sites may be reduced due to dust accumulation on foliage. During construction activities, erosion will continue to be controlled by commonly accepted procedures such as sedimentation ponds, hay-bale barriers and diversion ditches. As soon as possible after construction activities cease within the site, pipeline corridor and ancillary activities area, perennial grasses recommended by appropriate State and Federal agencies will be planted to control erosion permanently. The margins of sedimentation and ash runoff control ponds will be allowed to revegetate naturally with herbs and shrubs, though tree species will be discouraged. The power plant facilities site will be artificially surfaced and not allowed to revegetate during construction activities. This represents a long-term loss of local productivity for the duration of the proposed project (35 years).

Makeup Water Pipeline. Construction activities of the proposed makeup water pipeline will impact an easement 45.7 m (150 ft) wide and approximately 72 km (45 mi) long. The 308.3 ha (761.8 ac) of affected land outside of the Malakoff EGS/Trinity Mine boundary primarily consist of grassland and upland and bottomland forest. Areal extent figures, given in Table 5-25, are based upon the occurrence of communities along the centerline of the proposed 45.7-m (150-ft) wide pipeline right-of-way. Exact areal extent of the vegetational communities to be affected by pipeline construction depends upon the exact location to be chosen for the pipeline route. Potential impacts to the vegetation along the portion of the pipeline right-of-way which lies within the mine site boundary are discussed in the impacts section concerning the mine.

Construction impacts to the vegetation within the 45.7-m (150-ft) pipeline right-of-way will consist of elimination of vegetation where necessary to allow adequate space for the materials, equipment and activities essential to pipeline construction. Vegetation to be cleared from the pipeline right-of-way will be cut, piled and burned. Of the 45.7 m (150 ft) comprising the total right-of-way width, 12.2 m (40 ft) will be affected for the life of the project, while the remaining 33.5 m (110 ft) will be temporarily affected. The 33.5-m (110-ft) easement will be cleared during construction, but will revert to the landowner upon completion of construction. The 12.2-m (40-ft) easement, which will also be cleared during construction of the pipeline, will be maintained in low-growing vegetative ground cover for the life of the project. The 12.2-m (40-ft) corridor represents approximately 88.5 ha (218.9 ac) of vegetation that will be adversely impacted on a long-term basis.

MTFG Transmission Lines. Construction of the 2.4-km (1.5-mi) portion of the transmission lines which occurs outside of the Malakoff EGS/Trinity Mine site boundary will affect approximately 22.2 ha (54.6 ac) of terrestrial vegetation. Table 5-26 gives the areal extent of the vegetation types which will be affected by construction of the transmission corridor.

Construction impacts will involve clearing limited forested areas within the 91.4-m (300-ft) wide corridor. The transmission right-of-way will be maintained with low-growing vegetative ground cover for the life of the project, which will preclude forest growth.

Mine. Construction of the various ancillary facilities will remove vegetation from 116 ha (283 ac). Some of the ancillary facilities will be maintained for the life of the mine (35 years) or longer and, therefore, represent a relatively long-term removal of existing vegetation.

During construction activities, erosion will be controlled by commonly accepted structures such as minor stream diversions, sedimentation ponds, hay-bale barriers, catchment basins and overland flow-interceptor channels. Sediment control structures will be located as close to the sediment source as possible before concentrated flows enter the main streams. All necessary control structures will be constructed prior to the initiation of clearing and grubbing operations. The impacts on surface- and ground-water regimes in adjacent flood plains due to construction of surface-water control structures are short term and minimal; therefore, no adverse, water-related impacts due to construction will occur to vegetation in the flood plains adjacent to the mine area.

In order to minimize soil erosion and associated adverse impacts on downstream plant communities, a vegetative cover will be established on areas disturbed by construction as soon as feasible. Vegetation establishment on these areas will be done by use of equipment (e.g., hydroseeders), which can apply seed, mulch, binder and amendments in the same operation or by using other acceptable equipment.

Site preparation and construction will produce some unavoidable negative impacts to vegetation left standing adjacent to cleared areas. Primary production in vegetation immediately adjacent to construction sites may potentially be reduced due to dust accumulation on foliage or foliar injury due to exhaust emissions. In addition to the natural dust suppression provided by the abundance of annual precipitation in the region, several dust suppression measures will be incorporated during construction activities to further reduce the entrainment of fugitive emissions into the atmosphere. Such measures will include the spraying of roads and disturbed areas by water trucks, as needed, and the control of vehicle speeds along roads.

5.9.3.2 Impacts of Operation

Power Station. Impacts of power station operation are associated with the station site itself and the two major off-site transportive systems: the makeup water pipeline and the MTFG transmission lines.

Station Site. Operation of the proposed Malakoff EGS will result in the landscaping of areas cleared or otherwise disturbed during construction except for locations of buildings and structures. Vegetation in the area not affected during construction of station facilities, approximately 945 ha (2,300 ac), will not be directly affected during operation.

The limits of air contamination by gases and particulates beyond which biotic impacts become unacceptable are considerably higher than those concentrations predicted to be attained in the vicinity of the Malakoff EGS. Specifically, the maximum 3-hour, 24-hour, and annual SO_2 ground-level concentrations (GLC's) predicted for emissions from the proposed Malakoff EGS alone are 215.1 $\mu g/m^3$, 19.8 $\mu g/m^3$, and 3.7 $\mu g/m^3$, respectively (Radian Corporation, 1982). When emissions from the project are added to maximum existing background concentrations plus emissions from other area projects, the maximum 3-hour, 24-hour, and annual SO_2 GLC's are predicted to be 562.3 $\mu g/m^3$, 99.4 $\mu g/m^3$, and 7.0 $\mu g/m^3$, respectively (Radian Corporation, 1982). These predicted SO_2 GLC's are more than an order magnitude below the NAAQS primary and secondary standards. These predicted SO_2 GLC's are also far below the injury thresholds for sensitive plants of 1300 $\mu g/m^3$ and 650 $\mu g/m^3$ for 4 and 8 to 24 hours, respectively, reported by Shurtleff et al. (1972). Another study (EPA, 1976) indicates that sensitive vegetation such as alfalfa, peas, oats, etc., can tolerate exposures to SO_2 up to 2,489 $\mu g/m^3$ for one hour or 1,441 $\mu g/m^3$ for two hours or 917 $\mu g/m^3$ for four hours. Linzon (1978) found similar injury threshold doses of 1,820 $\mu g/m^3$ and 468 $\mu g/m^3$ for SO_2 exposures of one hour and eight hours, respectively, required to cause acute injury to native vegetation. Linzon (1978), however, also reported mild foliar symptoms in forest ecosystems during average SO_2 concentrations of 21-44 $\mu g/m^3$ over entire growing seasons. This concentration range over growing seasons is less than the NAAQS annual maximum GLC of 80 $\mu g/m^3$, but still several times greater than the maximum annual GLC of 7.0 $\mu g/m^3$ predicted from the Malakoff EGS plus background concentrations and all other area projects. Since the GLC's predicted from the project plus background concentrations and all other projects are far less than the above reported injury threshold doses, SO_2 concentrations resulting from the Malakoff EGS should have no significant impact on adjacent plant communities.

The maximum annual GLC's of NO_2 predicted from the proposed Malakoff EGS alone and in conjunction with both background concentrations and other area projects are 1.5 $\mu g/m^3$ and 17.8 $\mu g/m^3$, respectively (Radian Corporation, 1982). The maximum annual GLC of NO_2 predicted for the project plus background sources and other projects is far less than the NAAQS primary and secondary standard of 100 $\mu g/m^3$ as an annual average. The NO_2 concentration must be an order of magnitude greater than the NAAQS maximum during continuous exposure before plants are impacted (Hindawi, 1970). Also, at concentrations of up to 720 $\mu g/m^3$ (annual average), very little effect will be observed due to the exposure of vegetation to NO_2 (EPA, 1976). Furthermore, the National Academy of Sciences (1977) states that a NO_2 concentration of 1,900 $\mu g/m^3$ would require over 100 hours of exposure to produce phytotoxic symptoms. The National Academy of Sciences (1977) also states that NO_2 injury would be expected only in the immediate vicinity of an excessive industrial source. NO_2 concentrations expected in the area of the Malakoff EGS, therefore, should not impact local plant communities.

It has been suggested that coal-fired power plants and other sources of pollutants, particularly SO_2 and NO_x, may contribute to acid deposition, which is thought to cause functional injury to plants due to the gradual accumulation of acid-derived pollutants. Such subtle effects on vegetation, which are difficult to observe in the short term, include soil degradation, decreased nutrient recycling, and impairment of biotic predisposition to environmental variables. That such effects cause functional injury to plants is inferred from examples of long-term, wide-spread growth reductions in forestry, fruit culture and agronomic cultivation in areas experiencing acid deposition (Guderian, 1977). However, since the contribution of the proposed power station to the acid deposition phenomenon is still undetermined, it is inappropriate to speculate regarding such long-term impacts resulting from the operation of the proposed power staton.

Information reported in the literature on the effects of particulates on vegetation is limited. Particulate emissions from power stations with properly operating fly ash removal systems will cause minor (if any) injury to vegetation. Fugitive particulate emissions from ancillary facilities related to coal and limestone preparation and storage may locally reduce air quality and deposit on vegetation, but should not result in significant adverse impacts to vegetation.

Makeup Water Pipeline. During the operational phase of the makeup water pipeline, vegetation within the 12.2-m (40-ft) wide corridor will be maintained in low growing herbaceous ground cover, such as grasses and forbs.

MTFG Transmission Lines. Operational impacts, involving the maintaince of the 91.4-m (300-ft) wide corridor in a state of low-growing vegetative ground cover, such as grasses and forbs, for the life of the project, will be similar to those incurred by the makeup water pipeline.

Mine. Impacts upon terrestrial vegetation within the Trinity Mine site during operations will include the removal of natural vegetation in those ares to be mined and in adjacent areas used for the construction of haulroads, surface-water control structures and various right-of-way relocations.

A major impact of mine operation will be the removal of existing vegetation in the proposed mine area. During the 35-year life of the mining operations, a total of 15,621 ha (38,100 ac) of vegetation within the mine site will be removed by mining and 123 ha

(300 ac) will be removed as a result of mine related construction activities. Mining will occur progressively, with approximately 405.0 ha (1,000 ac) being disturbed at any given time (Sec. 4.5.7.4).

The temporal nature of the effect of habitat modification will vary, depending on the type of plant community pre-empted and the reclamation plan adopted. Pasturelands and croplands can be restored relatively easily. Although these agricultural systems contain ecologically complex communities of soil micoorganisms and intricate chemical balances that influence productivity, they are relatively simple with regard to both floral and faunal diversity when compared with undisturbed natural ecosystems such as forests, wetlands. Restoration of existing natural plant communities, predominantly upland and bottomland hardwood forest, in the mined area will be more difficult and require a longer period of time than for pastures and croplands. Therefore, the alteration of forested habitats will have a more long-term, adverse impact. Development of natural species diversity and relatively complex community structure characteristic of natural forest ecosystems will depend to a large extent on the process of natural succession. This process will be accelerated, at least with respect to common species, by the planting of woody species. During the early stages of succession after reclamation, common, easily dispersed plant species will invade the area, resulting in high net community productivity and low species diversity. The later successional stages will exhibit relatively low net productivity and high species diversity.

The reclamation plans provide for proper reconstruction of mining block contours, soil preparation, establishment of vigorous ground cover, and proper management of vegetation following establishment. Though the RRC regulations require the establishment of a diverse effective, and permanent vegetative cover of the same seasonal variety native to the area of disturbed land or species that support the approved postmining land use, individual landowners may request the postmining vegetation to be improved coastal bermudagrass pasture on lands that are presently forested. For these reasons, EPA has elected to evaluate two postmining vegetative cover scenarios, for the purpose of comparative impact assessment. The first scenario is conversion of areas impacted by mining to 100 percent managed pasture, typically coastal bermudagrass. The second scenario involves a return to premining vegetative cover on areas to be affected by mining which includes: 61.4 percent pasture/cropland, 20.9 percent upland forest and 11.5 percent bottomland forest.

Regardless of reason for conversion to coastal bermudagrass, such conversion brings with it a requirement for higher levels of management than do native grassland or forest species. Typcially, coastal bermudagrass pastures require higher levels of fertilizer to maintain high yields and may require the application of herbicides to control invader grass species and the application of insecticides to control insect pests. Therefore, for scenario one (100 percent coastal bermudagrass) not only will native vegetation be lost, but higher levels of management will be required.

For the second scenario (replacement of premining vegetative cover), native vegetation would be replaced in forested areas and some pasture areas that are not presently in introduced species.

With either of the scenarios examined, it may not be feasible to restore small wetland areas destroyed during mining. Impacts to wetland areas are considered significant and adverse.

For either reclamation scenario, erosion control prior to the establishment of a permanent vegetative cover will include temporary cover crops and mulching. The oxidation of the pyritic material generally found in association with lignite can result in more acid soil conditions (Hons et al., 1978) and potentially allow the accumulation of toxic concentrations of metals. However, because of the position of pyritic materials immediately above and below the lignite seams, selective handling of soils by the draglines will help avoid bringing pyritic material to the surface, thus minimizing this adverse impact. It is anticipated that some "hot spots" will exist during reclamation and mitigative measures such as liming or removal of the pyritic material from the surface with a minimum of 1.2 m (4 ft) soil cover will be required for any of the overburden handling options under consideration. Other potential effects on terrestrial vegetation during reclamation may result from earth moving, use and removal of haul roads, application of lime and fertilizers, seeding and planting of trees. Effects arising from these operations would include increased fugitive dust emission. However, these are not considered to be significant, adverse impacts on vegetation because of their short duration, in any given area.

5.9.3.3 Cumulative

Since vegetation is impacted primarily from the land requirements associated with lignite mining and power stations, the cumulative impacts can be assessed in terms of the total acreages affected. The proposed Malakoff EGS/Trinity Mine Project lies, for the most part, at the boundary of the Blackland Prairies and Post Oak Savannah vegetational areas, which cover a total of approximately 8.1 million ha (20 million ac) in east-central Texas (Gould, 1975). Figure 5-9 presents the location of existing and planned coal mines and power stations within these two vegetational areas, along with the location of near-surface lignite. There are an estimated 4.75 million ha (11.7 million ac) of near-surface lignite in Texas (Kaiser, 1980). General estimates place the near-surface lignite at 288,500 ha (712,500 ac) in the Blackland Prairies, and 769,200 ha (1.9 million ac) in the Post Oak Savannah. Therefore, the extent of the near-surface lignite covers about 6 percent of the total Blackland Prairies Ecological area and about 22 percent of the total Post Oak Savannah Ecological area. These percentage estimates represent the "worst-case" should all of the near-surface lignite be mined within these ecological areas. By assuming an average size of 8,097 ha (20,000 ac) for each existing and planned mine/power station, a total of 1.0 percent of the areal extent of the Blackland Prairies area and 1.2 percent of the Post Oak Savannah area will be disturbed by these energy projects. Currently, there are no known data to indicate the extent of sensitive wildlife habitats in the mining regions of Texas or to determine at what threshold the destruction of these productive habitats would become significant to wildlife. The most important cumulative impact on vegetation is the possibility that many of the ecologically sensitive plant communities (e.g., marshes, swamps, bogs, etc.) cannot or may not be fully re-established after reclamation. Therefore, these potential, cumulative adverse impacts constitute an irretrievable commitment of these important natural resources. Also, landowner preference usually dictates the ultimate land-use type after mining, with the trend being increased conversion to improved pasture. A long-term cumulative effect of this trend would be an adverse impact on native, natural vegetation.

Regional impacts on vegetation due to air contaminants will be minimal. The predicted low stack emissions of suspended particulates (fly ash), SO_2 and NO_x will not have any adverse effects on the region as a whole, due to dispersion. When stack emissions from the proposed generating station are reviewed in combination with all other regional sources of such air contaminants, no significant impact to vegetation is anticipated due to the relatively low concentrations when compared to the injury threshold for sensitive plants.

5.10 ENDANGERED SPECIES

5.10.1 Existing Environment

5.10.1.1 Terrestrial Wildlife

The American Alligator (Alligator mississippiensis) is the only species that may permanently reside in the Malakoff EGS/Trinity Mine Project area considered threatened or endangered by the USFWS (U.S. Department of the Interior, 1980). The American Alligator is rapidly increasing in numbers in Texas and the USFWS proposes to reclassify the status of the American Alligator throughout the state of Texas to threatened due to similarity of appearance as provided for by the Endangered Species Act of 1973, as amended. This proposed change is based on evidence that the species is no longer biologically endangered or threatened in Texas (Federal Register/Vol. 47, No. 177/ Monday, September 13, 1982). The TPWD has estimated that there are 500 American Alligators in Henderson County and 300 in Anderson County (Potter, 1981). In addition, TPWD estimated there are 26.3 alligators/2.59 km^2 (26.3/mi^2) of alligator habitat in Henderson County and 5.4 alligators/2.59 km^2 (5.4/mi^2) of alligator habitat in Anderson County (Potter, 1981). Henderson County has the fifth highest density of American Alligators within acceptable habitat of all Texas counties. This species was not observed during field surveys on the project area (EH&A, 1978; EH&A, 1982b; ECI, 1982a; NACCO, 1982b).

In addition to this potential resident species of the Malakoff EGS/Trinity Mine Project area, two federally listed endangered bird species may occasionally pass through the area as migrants or winter visitors. These are the Bald Eagle (Haliaeetus leucocephalus) and the Whooping Crane (Grus americana). Two Bald Eagles were observed near the project area on Trinidad Lake during February 1981 (EH&A, 1982a). No Whooping Cranes were observed during field surveys.

The eastern most portion of proposed makeup water pipeline will pass through areas that may be considered potential habitat for the Red-cockaded Woodpecker (Picoides borealis). The nearest known populations of Red-cockaded Woodpeckers occur approximately 8.0 km (5.0 mi) from the eastern end of the proposed pipeline within the Fairchild State Forest in Cherokee County. Preferred Red-cockaded Woodpecker habitat was not observed during an air and ground reconnaissance of the proposed route on June 16-17, 1982.

Coordination with the USFWS, pursuant to Section 7 of the Endangered Species Act, has been completed for the power plant and the makeup water pipeline. The USFWS has determined that there will be no effect on the continued existence of any species. EPA has prepared and submitted a Biological Assessment for the mine to USFWS indicating that there may be an effect on individual American Alligators and potential habitat of the Bald Eagle. USFWS and EPA are consulting to determine if there will be any danger to the continued existence of the Bald Eagle or the American Alligator from the mining activity.

5.10.1.2 Vegetation

None of the 12 plant species currently listed as endangered or threatened in Texas by the U. S. Fish and Wildlife Service (45 FR 82479-82569, 46 FR 3183-3186, 47 FR 19539-19542, Kologiski, 1982) are known to occur in Henderson or Anderson counties. The nearest listed endangered plant species, Navasota ladies'-tresses (Spiranthes parksii) (47 FR 19539-19542), is known from only two upland post oak woodland sites in northeastern and southeastern Brazos County. All past collecting sites also occur only in southeastern and northeastern Brazos County (Catling and McIntosh, 1979; Mahler, 1979 and 1980). These locations are approximately 145 km (90 mi) and 193 km (120 mi) south of the proposed Malakoff EGS/Trinity Mine Project area. Navasota ladies'-tresses has been determined to be endangered by USFWS because its extremely small population is vulnerable to collecting pressure, urban development and management of oak woodlands related to hunting and grazing.

Six plant species, which are currently being considered as candidates for Federal protection as threatened or endangered species, are known to occur in the vicinity of the Malakoff EGS/Trinity Mine Project area (Kologiski, 1982). One such species, Crataegus warneri, is known to occur in Anderson County. The other five species (Table 5-27) are known from counties adjacent to Henderson and Anderson counties. Table 5-27 lists the candidate species that may occur in the vicinity of the project area. Though these candidate species are not federally protected, they "should be considered in environmental planning" (45 FR 82479-82569).

The State of Texas has not promulgated an official list of endangered or threatened plant species.

TABLE 5-27

PLANT SPECIES OF POTENTIAL OCCURRENCE IN THE MALAKOFF EGS/TRINITY MINE PROJECT AREA AND TRANSPORTIVE CORRIDORS PRESENTLY UNDER CONSIDERATION BY THE USFWS AS CANDIDATES FOR THREATENED OR ENDANGERED STATUS[a]

Species[a]	Status[b]	Habitat Distribution[c]	Counties of Known Occurrence[c]
Abronia macrocarpa	1	On open dunes	Leon
Aster scabricaulis	2	In open wet areas in East Texas; endemic	Tyler, Smith, Van Zandt
Crataegus berberifolia	2	In low wet woods and on dryish hills in East Texas; endemic	Cherokee
Crataegus warneri	2	In sandy woods and on dry banks in East Texas; endemic	Anderson, Cherokee, Walker
Eriocaulon kornickianum	2	In springy places on prairies and wet sandy soil in East Texas	Brazos, Hardin, Leon, Tyler
Trillium texanum[d]	2	Extremely rare in low moist woods, bogs and stream banks	Cass, Harrison, Houston, Panola, Rusk

a. 45FR 82479-82569.

b. Status categories (45FR 82479-82569):
1 - Species currently under review that appear to be good candidates.
2 - Species whose status is insufficiently known and which need more study.

c. Correll and Johnston (1970) and Kologiski (1982).

d. Also listed on the Texas Organization for Endangered Species Watch List (1982).

5.10.1.3 Aquatic Species

No endangered or threatened aquatic species (e.g., fish, macroinvertebrates, etc.) are known to occur or could potentially occur within the Malakoff EGS/Trinity Mine Project area or in any area surrounding the project.

5.10.2 Impacts of No Action Alternative

If the proposed project is not constructed, potential impacts to threatened and endangered species will not be any greater or any less than they presently exist, with the exception of potential landowner influences and impacts of other actions in the area.

5.10.3 Impacts of Project Alternatives

5.10.3.1 Impacts of Construction

Power Station. EPA has prepared Biological Assessment Reports for the generating station and makeup water pipeline (EH&A, 1982e; EH&A, 1982g). EPA has concluded that construction of proposed generating station and makeup water pipeline will have "no effect" on threatened and endangered species.

Mine. EPA has prepared a Biological Assessment Report for the proposed Trinity Mine (EH&A, 1982f), and has concluded that construction of mine facilities will have "no effect" on threatened and endangered species.

5.10.3.2 Impacts of Operation

Power Station. EPA has prepared Biological Assessment Reports which conclude that operation of the proposed power station and makeup water pipeline will have "no effect" on threatened and endangered species.

Mine. EPA has concluded that operation of the proposed mine "may effect" the American Alligator and Bald Eagle, but should have "no effect" on other threatened and endangered species.

The "may effect" determination for the American Alligator results from the disturbance of approximately 576 ha (1,405 ac) of wetland habitat within the mine area. Wetland habitat including lakes, marshes and wet bottomland forest are potential American Alligator habitat. No American Alligators have been observed during field surveys on the project area (EH&A, 1978; EH&A, 1982b; ECI, 1982a; NACCO, 1982b).

The "may effect" determination for the Bald Eagle is also based on the loss of 1,854 ha (4,523 ac) of bottomland hardwood habitat that represents potential roosting habitat for overwintering individuals in the general vicinity of the proposed mine. Due to the availability of better quality habitat in the vicinity, the impact to the overwintering population resulting from removal of the bottomland hardwoods within the mine site is not considered significant.

5.10.3.3 Cumulative

Because the project will not have a significant impact on the continued existence of any listed threatened or endangered species, either directly or indirectly, no cumulative impact can reasonably be inferred. The proposed mine will affect potential American Alligator and Bald Eagle habitat. However, as discussed in Sec. 5.10.1.1, the American Alligator is rapidly increasing in numbers in Texas and the USFWS proposes to reclassify the American Alligator, based on evidence that the species is no longer biologically endangered or threatened in Texas. The availability and proximity of more suitable habitat for the Bald Eagle minimizes the significance of the removal of some bottomland forests during mining. Also, no designated critical habitat for any listed endangered or threatened species exists within the impact area of the project.

5.11 WETLANDS

This section discusses those wetlands determined by the USCE (1982) to be subject to regulation under Section 404 of the Federal Water Pollution Control Act, as amended (the Clean Water Act). Other hydric and aquatic habitats are discussed in Sec. 5.9.

5.11.1 Existing Environment

Wetlands are jurisdictionally defined by the USCE and Executive Order 11990 of 1977 as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalance of vegetation typically adapted for life in saturated soil conditions. The EPA has ultimate responsibility for Section 404 wetland determinations, though responsibility is usually delegated to the USCE unless a special case is determined to exist. Vegetative, hydrologic and soil variables are utilized to delineate regulatory wetlands. The dominant species within a plant community are utilized to define the above regulatory term "a prevalence of vegetation" (Huffman, 1981). Once the dominant species are known, lists of wetland indicator plant species recognized by EPA and the USCE are examined for similarities in order to define the regulatory term "typically adapted." The variables related to hydrology include drift lines, silt deposition, water marks, an active water table in the root zone, stream gage data, flood predictions, historical records, visual observations and drainage patterns. Soil variables include a mottled or gleyed soil horizon, the presence of iron or manganese concretions or nodules, the presence of free water within the root zone, and hydric classification of soil series. The general consensus among the regulatory agencies is that the definition of 404 wetlands should also include annual inundation for a period of 30 days during the growing season.

The USCE Fort Worth District has determined that there are 1,440.5 ha (3,560 ac) of wetlands in the proposed Malakoff EGS/Trinity Mine site (see Appendix D). Of the areas determined as wetlands by the USCE, 1,123.3 ha (2,776 ac) occur adjacent to Cedar Creek and the Trinity River. These areas are within USCE jurisdiction under Section 404 and downstream from the headwaters of Section 404 streams. The remaining 317.2 ha (784 ac) are also within the area of jurisdiction under Section 404, but upstream of the headwaters. In addition, 102.4 ha (253 ac) of impoundments upstream of the headwaters were delineated by the USCE. Figure 5-11 also includes wetlands which occur outside the Malakoff EGS/Trinity Mine boundary, below the Cedar Creek Lake dam, a small acreage of which will be impacted by construction and operation of the proposed MTFG Transmission Lines associated with the project. The hydric communities within the proposed right-of-way of the makeup water pipeline were determined to all be above the headwaters (USCE, 1982).

Bottomland hardwood forests are discussed in detail in Sec. 5.9.1. A portion of the wet bottomland forests in the Malakoff EGS/Trinity Mine site and adjacent to the MTFG transmission lines corridor were designated as wetlands by the USCE (Fig. 5-11). Plant species which dominate these wetlands include overcup oak, willow oak, sugarberry, honeylocust, cedar elm, green ash, water hickory and eastern cottonwood in the overstory. Species in the understory include hawthorn, boxelder, swamp privet (Forestiera acuminata), common persimmon and deciduous holly.

Swamp communities designated as wetlands by the USCE (Appendix D) are dominated by overstory species such as black willow, green ash, overcup oak, willow oak, cedar elm, boxelder and honeylocust. Species occurring in the understory include common buttonbush and swamp privet.

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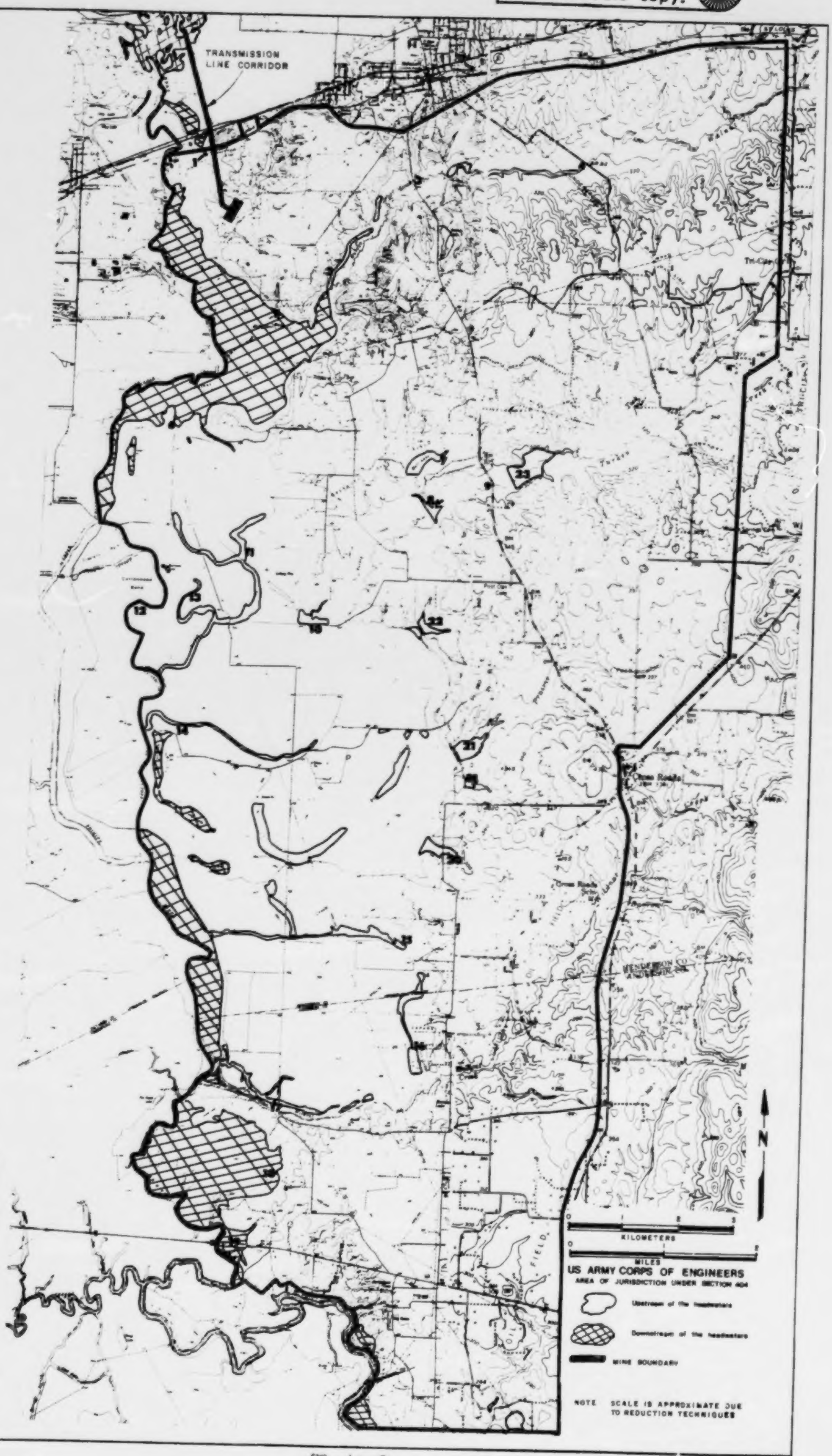

TRANSMISSION LINE CORRIDOR
Cross Roads
FIELD
N
0 1 2 3
KILOMETERS
0 1 2
MILES
US ARMY CORPS OF ENGINEERS
AREA OF JURISDICTION UNDER SECTION 404
Upstream of the headwaters
Downstream of the headwaters
MINE BOUNDARY
NOTE SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-11

U S ARMY CORPS OF ENGINEERS
AREA OF JURISDICTION UNDER SECTION 404

Marshes occur in areas where drainage is impeded, and along margins of impoundments and streams. Typical emergent species in USCE-designated wetlands include sedges, soft rush, beak rush (Rhynchospora sp.), cattail, arrowhead, smartweed, water primrose and spikesedge (Eleocharis sp.). Sea-myrtle, black willow and common buttonbush form a shrub layer in some marsh habitats (Appendix D).

Aquatic habitats designated as wetlands in the project area typically support a band of sedges, rushes and smartweeds around the water's edge. Black willow and common buttonbush also occur.

5.11.2 Impacts of No Action Alternative

If the proposed project is not constructed, potential impacts to wetlands will not be any greater or any less than they presently exist, with the exception of potential landowner influences and impacts of other actions in the area.

5.11.3 Impacts of Project Alternatives

5.11.3.1 Impacts of Construction

No direct impact on wetlands due to power station construction is anticipated. However, the construction of the makeup water pipeline will impact wetland areas (all above the headwaters) of several streams it will cross along its length. Construction of the makeup water intake structure will necessarily impact a small area of wetlands adjacent to the Neches River. Transmission line construction is expected to directly impact approximately 3.5 ha (9 ac) of regulatory wetlands within the flood plain of Cedar Creek. The lignite conveyor will also affect a small area of wetlands, approximately 2.67 ha (6.5 ac) based on a 12.2-m (40-ft) wide corridor. Construction activities at the mine are expected to directly impact a relatively small area of wetlands during construction of the access road and relocation of existing pipelines and transmission lines within a defined corridor.

Soil erosion and associated adverse impacts to wetlands not directly impacted by construction, but adjacent and downslope to construction, will be minimized by a vegetative cover which will be established as soon as feasible on areas disturbed by construction activities. Erosion and flooding will be further controlled by such commonly accepted structures as sedimentation ponds, hay-bale barriers, catchment basins and overland flow-interceptor channels. The construction of sedimentation ponds will not cause measurable adverse impacts to wetlands and flood plains located downstream.

5.11.3.2 Impacts of Operation

The only wetland areas to be impacted during operation, in addition to those affected during construction, will be a result of mine-related activities.

No ground-water impacts on wetlands in the flood plains proper would be expected, since the normal flow and seasonal flooding of major drainages will not be impeded. The adverse impacts associated with dewatering exist until the ground water levels return to pre-mining conditions. However, even minor changes to the water input may have some adverse consequences for wetlands not in the Trinity River flood plain that are dependent upon seeps and springs originating in adjacent upland areas to be disturbed by mining activities. Therefore, the adverse impacts of dewatering will last for 10 to 50 years and will be significant to certain wetland communities.

Adverse impacts to wetlands adjacent to areas to be mined caused by the redeposition of a generally homogenous spoil during reclamation of mined areas may be longer term than those associated with dewatering. The redistribution of geologic materials may retard the up-gradient recharge to existing seeps along the Walnut Creek. The ground-water flow to streams in the vicinity of the mine area may be further reduced by being diverted around reclaimed areas and away from traditional discharge points. The alteration of recharge zones in upland areas may change the long-term baseflow to streams within the Trinity Mine area. The potential reduction of this flow will adversely affect any wetland communities that are dependent on this phenomenon along Walnut Creek. The primary adverse impact of the reduction of such baseflow would be long-term desiccation, which would be a significant, adverse impact to certain wetland communities.

Wetland areas within the areas to be actively mined will be lost. Wetland acreages in the areas to be mined, including both those above and below the headwaters, total 576 ha (1,405 ac). Loss of wetland areas may be permanent due to local changes in topographic relief, and decreased upgradient recharge of springs and seeps. The mining activity will require approximately 50 sedimentation basins. Of these, 20 percent will be eliminated by mining and the balance will be left as postmining stock watering ponds. These basins will resemble existing stock ponds with regard to biological productivity and will not provide the quality of wildlife habitat currently found in existing marsh, swamp and wet bottomland hardwood forests. If none of the sediment ponds are left in place, the impact would represent a total loss of wetland acreage with no mitigation. The loss of wetland areas is considered to be a long-term, significant, adverse impact.

NACCO intends to mine a 321-ha (783-ac) block within the Trinity River flood plain which has been determined to be wetlands by the USCE. Before mining, NACCO proposes to construct a flood protection levee. This area is presently dependent on Trinity River flood flows. Once the levee is built, these flood flows will be diverted. Once mining is completed NACCO may or may not remove the flood protection levee, depending on regulatory approvals. If the levee remains, the wetland character of this area will probably never be reestablished. However, dependent upon the postmining soil and topographic relief, return to premining conditions may be possible if the levee is removed following mining and reclamation operations.

A summary of the evaluation of the proposed project in accordance with Section 404(b)(1) guidelines is presented in the following paragraphs. Discharges of sediment from the proposed mine site and ancillary areas into adjacent aquatic ecosystems shall be eliminated by revegetation and such erosion-control structures as sedimentation ponds, hay-bale barriers, catchment basins and overland flow-interceptor channels.

Adverse effects upon water quality downstream of the project area will for the most part be restricted to construction activities related to installation of surface-water control facilities. Vegetation removal and earthmoving activities will result in increased erosion potential of the affected areas, so that higher than normal sediment yields may be delivered to area streams if precipitation occurs before completion of the facilities. Susceptibility to erosion will be minimized by clearing only the land immediately ahead of the overburden removal process and by initiating vegetation establishment measures as soon as possible following soil reconstruction. A maximum of 405 ha (1,000 ac) of land will be exposed to potential erosion at any given time (Sec. 4.5.2.4).

Local peak runoff discharges may temporarily increase during premining construction and land-clearing activities before sedimentation ponds are completed, then decrease during active mining as all runoff is routed through sedimentation ponds. As discussed previously, a more long-term impact to surface water quantity supplied to downstream wetlands will be the disruption of shallow aquifers in mined areas which may diminish ground water-induced baseflow of seeps and minor streams which are mined through. Possible dewatering will have a similar impact, but will be more short term.

Appendix A provides a comprehensive evaluation of the effects of project related activities on wetlands.

5.12 CULTURAL RESOURCES

5.12.1 Existing Environment

5.12.1.1 Cultural Background

The cultural history of northeastern Texas may be divided into at least four temporal sequences: Paleo-Indian, Archaic, Neo-American and Historic. The prehistoric divisions reflect changes in subsistence as exhibited by material remains and settlement patterns.

Paleo-Indian. The Paleo-Indian Stage is the earliest well-defined sequence in North America. These Indians were nomadic followers of the megafauna of the late Pleistocene. Their sites have been found throughout most of the continental United States, but in the southeast these finds have mainly been limited to unassociated surface collections, usually restricted to upland terraces (Jackson et al., 1978). Artifacts diagnostic of the Paleo-Indian Stage are distinctive, finely worked, lanceolate projectile points, such as Clovis, Folsom, Scottsbluff, Angostura, Meserve and Plainview (Willey, 1966). Northwest of the project in the Trinity River drainage, three anthropomorphic heads, carved from sandstone, were found in gravel deposits in context with skeletal remains of extinct horse, camel, bison and mammoth (Sellard, 1941). Documented evidence of Paleo occupation, the medial section of a Folsom point and a basal fragment of a possible Eden point, was recovered at the Wild Bull Site in the Cedar Creek Reservoir (Story, 1965). Airtaker, a multicomponant site near Trinidad, yielded a vast collection of cultural materials spanning the Paleo-Indian through the Neo-American periods (Hatzenbeuhler, 1947).

This early stage terminated with a culture which exhibited slightly decreased nomadism. The people were the makers of a distinctive point type known as San Patrice. This culture may have been transitional between the Paleo-Indian and Archaic stages.

Archaic. The Archaic Stage exhibits more regional diversity as sites reflect an increase in environmental exploitation. As the abundant game of the Pleistocene began to decline, man increased his usage of plants that could be gathered. Small forest animals and aquatic life were increasingly hunted and gathered. A tool kit adapted to a hunting and gathering economy was developed. These tools, broad less refined projectile points, mortars and pestles, grinding stones, nutting stones and stone vessels, reflect this change.

Typical point types for this region are the Gary, Ellis, Yarbrough, Kent and Wells (Shum et al., 1954). Sites of the Archaic Stage in east Texas may be affiliated with the La Harpe Aspect as described by Johnson (1962:268-285).

Neo-American. The Neo-American Stage began with incipient agriculture and extended to the period of European contact. During this stage people became more sedentary. Social organization became increasingly complex. This is evidenced by the cooperative construction of low ceremonial earthenworks. The beginning of agriculture usually coincides with two changes in artifact assemblages: the bow and arrow and ceramic vessels. In east Texas and adjacent parts of Louisiana, Arkansas and Oklahoma, this stage is synonomous with the name Caddo. Caddoan developmental history began at approximately A.D. 700 and lasted until the newly-founded Republic of Texas evicted the Caddo in the 19th century (McLure and Howe, 1937). Caddoan prehistory is divided into the Gibson and Fulton Aspects, and into local or chronological foci. Nearby manifestations of the Gibson Aspect have been identified as Alto and Sanders Foci, while the Fulton Aspect has four local subdivisions: Whelan Complex, Titus Focus and the protohistoric Kinsloe and Allen Foci. These two aspects have been further subdivided into five periods: Caddo I and II (Gibson); Caddo III and IV (Fulton); and Caddo V (Historic).

Caddo I. Caddo I is represented by the Alto Focus (A.D. 500 to 1300) in the project area. The type site, the George C. Davis Site, located in Cherokee County, revealed three large ceremonial mounds. Diagnostic cultural materials include Alba arrow points, Holly and Hickory Fine Engraved, Crockett-Pennington, Davis and Dunkin Incised and Weches Fingernail Impressed ceramic vessels (Newell and Krieger, 1949; Davis, 1970).

Caddo II. The Sanders Focus is the local manifestation of the Caddo II Period. Radiocarbon dates obtained from a Sanders Focus occupation at the Sam Kaufman Site range from A.D. 950 to 1080 (Skinner et al., 1969). The practice of mound building continued with the recovery of carved shell gorgets suggest possible Mississippian influence (Richner and Lee, 1976). Four-edged beveled knives and bison scapula present on Sanders Focus sites indicate a Plains influence (Davis, 1970). Ceramic diagnostic time indicators are Sanders Plain, Sanders Engraved, Canton Incised, Maxey Noded Redware and Monkstown Fingernail Punctated (Richner and Lee, 1976). Other diagnostics inlcude Bonham and Perdiz arrow points, shell beads and gorgets and copper covered earspools.

Caddo III. The Whelan Complex, the Caddo III component in Texas, has been radiocarbon dated to the 15th century (Davis, 1970). Sites consisting of single or multiple clusters of small mounds with accompanying human burials and house structure remains are found on flood plains of creeks. Diagnostic cultural materials include Ripley and Taylor Engraved, Bullard Brushed and Maydell Incised ceramic types and Perdiz arrow points (Davis, 1970).

Caddo IV. The Frankston Focus is the Caddo IV corralary in the Trinity and Neches river drainages in East Texas. Sites consist of small scattered hamlets containing from one to three houses (Anderson et al., 1974). They occasionally exhibit mound structures. The recovery of non-indiginous stone tools and ceramics suggests an extensive trade network. Representative diagnostic cultural material types include Bassett, Talco and Maud arrow points and Maydell Incised, Poynor Engraved, Killough Brushed and Bullard Brushed ceramic types.

Caddo V. The Allen Focus, A.D. 1600-1800, is the Caddo V component in central east Texas. The type site, the Jim Allen Site, is located in Cherokee County. Caddo V, situated along minor streams, are small villages usually accompanied by a cemetery area in or adjacent to the refuse area. Burials were single interments, extended on the back, with vessels around the head and shoulders. Subsistance was based on agricultural supplemented by hunting, fishing and gathering wild foods. Diagnostic ceramic types are Pattton Engraved (the principal type), Hume Engraved (a minor type) and small amounts of Killough Pinched and Maydell Incised carried over from the Frankston Focus. The temper is predominantly fine sand or mixed fine clay grit and sand. Diagnostic lithics are Cuney and Turney arrow points; Talco, Fresno and Alba points are also found (Suhm et al., 1954 and 1962).

Historic. Sites of the Historic Stage may be defined as those sites which exhibit goods of a European nature. In this area historic sites will probably represent homesteads of early settlers or, more likely, farms from the period of reconstruction to the great depression of the early 20th century.

5.12.1.2 Prediction of Occurrence of Cultural Resource Sites within the Project Area, Based on Previous Surveys Conducted in the Project Region

A survey of approximately 20,500 ha (50,000 ac), in connection with the Richland Creek Reservoir in Navarro and Freestone counties, recorded a total of 911 cultural components (1 per 22.6 ha (55 ac)), including 442 cultural resources sites (1 per 46.3 ha (113 ac)). Of these sites, 208 are historic, 66 are multicomponent and 168 are prehistoric. Testing was conducted on 188 historic and 43 prehistoric. A total of 95 sites (1 per 215.7 ha (526 ac)), 74 historic and 21 prehistoric, was recommended as significant in terms of NRHP criteria (Raab et al., 1982).

Another survey overlapping a portion of the project area recorded 181 cultural resources sites. Sixty-one sites were within 57 survey units (12,510 ha (10,512 ac)) or 1 site per 219.4 ha (535 ac); of 7,247.6 ha (17,677 ac) surveyed, 5,155.8 ha (12,575 ac) of flood plain area yielded no sites and the remaining 2,091.8 ha (5,102 ac) of terrace and upland areas yielded 40 sites or 1 site per 52.5 ha (128 ac). An additional 121 sites were recorded outside of the surveyed units as a result of local interviews. Of the 181 sites, 136 are located on terraces, 30 in upland areas and 15 in lowland areas. Large midden sites cluster in areas central to natural resources such as major water sources, food and lithic materials, while temporary camps are located both at headwaters of smaller tributaries and on larger tributaries. Site densities of 1 site per 20.5 to 28.7 ha (50 to 70 ac) can be predicted in the transition zones (terraces) of the unsurveyed portions of the project area (Richner and Lee, 1977).

A 100 percent survey of a 980 ha (2,390 ac) tract west of Walnut Creek located 6 prehistoric and 23 historic sites or 1 site per 33.6 ha (82 ac). Poor surface visibility due to dense vegetation and the unstable nature of sandy surface soil which permits rapid covering of surface debris may have prevented the identification of additional cultural resources sites within the area (EH&A, 1982).

Based on the results of previous work in the area, the probability of locating additional cultural resources sites in the unsurveyed portions of the project area is extremely high ranging from a high of 1 site in 22.6 ha (55 ac) (Raab et al., 1982) to a low of 1 site per 219.4 ha (535 ac) (Richner and Lee, 1977). Within the project area, additional sites may be located on the terraces above Walnut Creek, Wildcat Creek, Cedar Creek, Turkey Creek, Tick Branch, Sycamore Creek and Prairie Creek drainages. In terms of eligibility to the NRHP, site probability ranges from a high of 1 site to 163.2 ha (398 ac) (EH&A, 1982) to a low of 1 site per 215.7 ha (526 ac) (Raab et al., 1982).

5.12.1.3 Cultural Resources within the Project Area

The proposed Malakoff power station and mine area comprise 23,616 ha (57,600 ac). A review of the records indicates that 3,997 ha (9,868 ac), or 17 percent of the project area, has been previously surveyed as part of four separate studies. The first study, an archaeological and ethnohistorical survey at Tennessee Colony Lake, conducted by Southern Methodist University (SMU), recorded 11 cultural resources sites within the project area (Richner and Lee, 1977). The second study, a reconnaissance survey of the Trinity River Basin also conducted by SMU, recorded 17 cultural resources sites within the project area (Richner and Bagot, 1978). The third study, a cultural resources survey and testing program of 574 ha (1,400 ac) in the Malakoff-Cayuga Mining area conducted by North Texas Archaeology Laboratory, recorded seven cultural resources sites within the mine area (Hays and Larson, 1978a and 1978b). The fourth study, a 100-percent survey of 980 ha (2,390 ac) on the Malakoff Electric Generating Station Site, conducted by EH&A, recorded 29 cultural resources sites (EH&A, 1982h). A total of 64 cultural resources sites was recorded within the project boundaries as a result of these surveys. Included are 22 prehistoric sites, 32 historic sites and 10 multi-component prehistoric and historic sites.

No known cultural resources sites on or which have been determined eligible for inclusion on the National Register of Historic Places (NHRP) are within the surveyed portion of the project area. Within the area surveyed for the power station site, four prehistoric sites (41HE200, 41HE204, 41HE208 and 41HE220) and two historic sites (41HE206 and 41HE212) were recommended for further testing to determine their eligibility to the NRHP, if final project plans call for disturbance in the area of these sites. These cultural resources sites were recorded in the 1982 report by EH&A. A brief description of each site follows:

41HE200. This site is a prehistoric camp located on a tributary of Walnut Creek. Lithic materials were exposed on the surface in an area 100x15 m. Shovel tests yielded cultural materials to a depth of 15 cm. Additional testing has been recommended to determine National Register eligibility, if site disturbance is anticipated.

41HE204. This site is a prehistoric camp overlooking a tributary of Cedar Creek. Lithic materials, including one Morrill-like dart point, were scattered over an area 100 m in diameter. Additional materials were recovered in shovel tests at 10 cm. Testing has been recommended to determine National Register eligibility, if site disturbance is anticipated.

41HE206. A hand-dug well and other structural evidence (possible footings and/or rubble) which mark the former location of a residence are located on property owned by the Willbanks, a family which was present in Henderson County by 1850-1860. Further research has been recommended before a determination of National Register eligibility can be made, if site disturbance is anticipated.

41HE208. This site, a prehistoric campsite, overlooks a tributary of Cedar Creek. Cultural materials exposed on the surface in an area 100 m in diameter include lithic debitage, one arrow point fragment and one prehistoric ceramic sherd. Shovel tests yielded additional lithic and ceramic materials at a depth of 10-15 cm below ground level. Limited testing has been recommended to confirm the existence of intact cultural features for a determination of National Register eligibility, if site disturbance is anticipated.

41HE212. This early homesite was evidenced by brick fragments, glass, china, pottery and metal. There were no structural remains. The artifact assemblage indicates an early construction date. The land is owned by the Willbanks, a family which was present in Henderson County by 1850-1860. Further research has been recommended before a determination of National Register eligibility can be made, if site disturbance is anticipated.

41HE220. This site is a prehistoric campsite overlooking a tributary of Cedar Creek. Lithic detibage was found on the surface and in three shovel tests. Testing has been recommended to determine National Register eligibility, if site disturbance is anticipated.

Within the mining section of the project, 15 cultural resources sites, discussed below, have been listed as having good or questionable potential for further work (see Table 5-28).

X41HE100. This historic site is located on a remnant terrace east of Stephens Lake in Henderson County. It is the former location of a plank house built in 1900 for the caretaker, Will Hendrix, of the Island Fish and Game Club (X41HE102). The house consisted of a kitchen and bedroom with a porch across the front and a shed attached to the back. The structure fronted on the Palestine-Corsicana Road. The only remaining structural evidence is a well and an historic scatter. Potential for further work (in situ analysis) at this site is listed as good (Richner and Bagot, 1978).

X41HE101. This historic site is located north of X41HE100 on a remnant terrace east of Stephens Lake in Henderson County. A split log cabin was constructed on the site in

TABLE 5-28
CULTURAL RESOURCES SITES WITHIN THE MINE AREA RECOMMENDED FOR ADDITIONAL WORK

Site Number	Survey[a]	Cultural Affiliation	Potential for Further Work
X41HE100	TRB	Historic	good
X41HE101	TRB	Historic	good
X41HE102	TRB	Historic	good
X41HE103	TRB	Historic	?
X41HE104	TRB	Historic	?
X41HE105	TRB	Historic	?
X41HE135	TRB	Neo-American	good
X41AN53	TRB	Prehistoric	good
X41AN55	TRB	Prehistoric	good
X41AN56	TRB	Prehistoric	good
X41HE78	TCL	Archaic/Neo-American/ Historic	+
X41HE81	TCL	Archaic/Neo-American	+
X41HE82	TCL	Neo-American	?
X41AN17	TCL	Neo-American/Historic	+
X41AN18	TCL	Archaic/Neo-American	+

a. TCL = Tennessee Colony Lake (Richner and Lee, 1977).
TRB = Trinity River Basin (Richner and Bagot, 1978).

1863 as part of the Stephens Lake Ranch cotton plantation. The structure, a split log cabin consisted of one room 4.9 x 4.9 m (16 x 16 ft), has a fireplace on the west side and a shed room on one side constructed of lumber that had been added after the original construction. The structure fell into disrepair with the enactment of the Emancipation Proclamation and the subsequent failure of the plantation system. All that remains on the site now is an historic scatter. Potential for further work (in situ analysis) at this site is listed as good (Richner and Bagot, 1978).

X41HE102. This historic site is situated on a remnant terrace due east of Stephens Lake in Henderson County. The site consists of a standing two-story frame structure with a well and a fence and is in use today as a vacation dwelling. It was constructed in 1912 as a club house for the Island Fish and Game Club. Since 1963 the land has changed hands a number of times. The land is presently being used for the production of hay and beef. The area of this site is 100 x 100 m. Potential for further work (in situ analysis) at this site is listed as good (Richner and Bagot, 1978).

X41HE103. This historic site is situated on a remnant terrace due east of Stephens Lake in Henderson County. The site is the former location of a barn built in 1915 by the Island Fish and Game Club. All that remains on the site is an historic scatter. The barn is not standing. Potential for further work on this is questionable (Richner and Bagot, 1978).

X41HE104. This historic site is situated on a remnant terrace due east of Stephens Lake in Henderson County. It is the former location of a plank house constructed in 1891 on the Stephens Lake Ranch for recreational use in conjunction with a boat house (X41HE105). The original structure contained only one room; however, subsequent additions expanded it to four rooms and a screened-in porch. The house was torn down in 1972. Potential for further research on the site is questionable (Richner and Bagot, 1978).

X41HE105. This historic site, Ramsey Ferry Crossing, is located on the flood plain adjacent to "the cut off" at its intersection with the old Palestine-Corsicana Road in Henderson County. It was established in the first half of the 19th century to provide a land service route for a plantation located on the east side of the Trinity River. During post-civil war times, the ferry serviced the tenant cotton farming industry. It ceased operation in 1925 with the construction of a highway bridge. Two cottonwood trees that served as anchor posts for the ferry cables and the road leading to the ferry are all that remain of the site. Potential for further research on the site is questionable (Richner and Bagot, 1978).

X41HE135. This prehistoric site is located on a flood plain rise on the old Trinity River Channel at the north end of Stephens Lake in Henderson County. The site covers an area 20 x 25 m and 120 cm in depth. Ceramic materials recovered from a midden area indicate an early Neo-American occupation. Potential for analysis on this site is considered good (Richner and Bagot, 1978).

X41AN53. This prehistoric site is located on a cut bank on the eastern shore of the Trinity River in Anderson County. The site, measuring 200 m in length and 500 cm in depth, contains nine shell lenses exhibiting no visible lithic material. Extensive testing was conducted at this site as part of the Trinity River Survey; however, at that time the horizontal extent of the lenses was not determined and it is possible that there may be in situ cultural materials in the unexposed portions. Cultural affiliation is undetermined. Potential for analysis is good. Excavation and/or protection is recommended (Richner and Bagot, 1978).

X41AN55. This prehistoric site is located on a cut bank on the first terrace above the Trinity River south of X41AN53 in Anderson County. The site is a shell midden made up of several shell lenses 50 m in length. Two test units, totaling 28.5 m^2, were excavated as part of the survey in an attempt to determine the research potential of shell middens in the area. The in situ deposits contained chipped stone, fire-cracked rock and faunal materials. Cultural affiliation has not been determined. Potential for analysis is good (Richner and Bagot, 1978).

X41AN56. This prehistoric site is situated in a cut bank on the east side of the Trinity River in Anderson County. It consists of a shell lense 3 m in length and 5 to 7 cm in depth. The lense contained no lithic material; however, charcoal remains are present. Cultural affiliation has not been determined. Potential for analysis is good (Richner and Bagot, 1978).

X41HE78. This prehistoric site is situated on the north edge of a second terrace above the Trinity River flood plain east of Stephens Lake in Henderson County. Lithics, ceramics, charcoal and faunal materials were recovered from the site. The northern portion is deflated with clay at 6 cm; however, there is a midden on the western hill with 100 cm of deposition. The total size of the scatter is 133,000 m^2. Cultural affiliation is Archaic, Neo-American and Historic. Good research potential exists in the midden and on the knoll east of Stephens Lake (site form on file at TARL).

X41HE81. This prehistoric midden site is located on a terrace edge of the Turkey Creek drainage in Henderson County. The site contains a wide and fairly dense lithic scatter (100 m^2) with a depth of 100 cm. The cultural affiliation is Archaic and Neo-American. Sand quarrying activities have caused moderate disturbance to the site. Potential for analysis is + on a scale of -, ? and + (Richner and Lee, 1977).

X41HE82. This prehistoric site is located on a sandy rise at the edge of a terrace west of Turkey Creek in Henderson County. Lithics, ceramics and fire-cracked rocks were observed over a 2,500-m^2 area to a depth of 120 cm. The site has been subjected to moderate disturbance by oil wells. Cultural affiliation is Neo-American. Research potential is listed as ? on a scale of +, - and ? (Richner and Lee, 1977). Research potential is good (site form on file at TARL).

X41AN17. This multicomponent prehistoric-historic site is situated on a terrace edge 2.4 km southeast of the confluence of Wildcat Creek and the Trinity River in Anderson County. The historic component contains a log cabin with a fireplace. Lithic material, fire-cracked rocks and charcoal were collected from the prehistoric component. The cultural affiliation of the prehistoric component is Neo-American. Site size is undetermined, depth of cultural material is 60 cm. Site disturbance is low; the area is wooded. Potential for analysis is + on a scale of +, - and ? (Richner and Lee, 1977).

X41AN18. This prehistoric midden site is situated on a terrace edge east of the Trinity River in Anderson County. Lithic and ceramic materials collected from the site indicate an Archaic to Neo-American occupation. The scatter size is 40,000 m^2, the depth of the cultural material is 400 cm. A large area of the site has been destroyed by a quarry; however, it appears that the site may extend north and testing is recommended (site form on file at TARL). Potential for analysis at the site is + on a scale of +, - and ? (Richner and Lee, 1977).

5.12.2 Impacts of No Action Alternative

If the proposed power station and mine are not constructed, environmental conditions within the project site will remain approximately as they presently exist, including cultural resource site deterioration due to natural weathering, erosion, continued bulldozer clearing, sand and gravel quarrying, oil and gas development, cultivation and possible vandalism (Richner and Lee, 1977).

5.12.3 Impacts of Project Alternatives

5.12.3.1 Impacts of Construction

Power Station. A 100-percent survey of 980 ha (2,390 ac) located 29 cultural resources sites: 6 prehistoric and 23 historic (EH&A, 1982h). The area surveyed includes the main plant site, railroad spur landfill, a portion of the transmission facilities and a minor portion of the makeup water pipeline corridor. Six sites have been recommended for further testing to determine their eligibility for inclusion on the NRHP, if project plans call for disturbance in the area of the site locations. They are as follows: 41HE200, prehistoric campsite; 41HE204, prehistoric campsite; 41HE206, historic structure site; 41HE208, prehistoric campsite; 41HE212, historic structure site; and 41HE220, prehistoric campsite. Any sites determined to meet National Register of Historic Places eligibility will be mitigated, if necessary, to ensure protection of significant cultural resources which will lessen the impact of construction.

One cemetery, Antioch Cemetery (41HE216), is located immediately adjacent to the power station site. It is situated outside of the area to be directly impacted by construction activities. Because the cemetery lies outside the power station boundary, no construction related impacts are anticipated.

Makeup Water Pipeline. In July of 1982, a cultural resources records review (literature review) conducted of the area within the 0.8-km (0.5-mi) wide study corridor, approximately 72.5 km (45 mi) in length, revealed the location of ten cultural resources sites (nine historic and one prehistoric). The historic sites were recorded during a 100-percent survey of the Malakoff EGS site (EH&A, 1982h) and were not recommended for further work. The prehistoric site (41AN44), a burial, was located in 1934 by the landowner and was excavated in 1935 by the University of Texas (Woolsey, 1935). All of these cultural resources sites are situated outside of the 45.7-m (150-ft) wide construction right-of-way and the 12.2-m (40-ft) wide operations right-of-way. However, as only that portion of the makeup water pipeline situated within the boundary of the Malakoff EGS site has been surveyed, the possibility exists that additional cultural resources sites may be found in unsurveyed areas.

Mine. Surveys conducted on 12 percent of the proposed mine site have identified 35 cultural resources sites (Richner and Lee, 1977; Richner and Bagot, 1978; Hays and Larson, 1978a and 1978b) (see Table 5-28). These 35 sites will not be impacted by construction related activities in the mine area. Surveys of the remaining 88 percent of the proposed mine site could reveal the location of additional cultural resources sites that may be eligible for inclusion on the NRHP.

5.12.3.2 Impacts of Operation

Power Station. During a 100-percent survey of the area, 29 cultural resources sites were located. Six of these sites have been recommended for further testing to determine their eligibility for inclusion on the NRHP, if final project plans indicate potential disturbance to these areas. The sites are: 41HE200, prehistoric campsite; 41HE204, prehistoric campsite; 41HE206, historic structure site; 41HE208, prehistoric campsite; 41HE212, historic structure site; and 41HE220, prehistoric campsite. Operation of the power station should have no additive effect on cultural resources beyond those, if any, experienced as a result of construction.

Mine. Surveys conducted on 12 percent of the proposed mine site have identified 35 cultural resources sites (Richner and Lee, 1977; Richner and Bagot, 1978; Hays and Larson, 1978a and 1978b). Surveys of the remaining 88 percent of the proposed mine site could reveal the location of additional cultural resources sites that may be eligible for inclusion on the NRHP.

The operation of the mine will result in the loss of cultural resource sites but recovery of cultural resource data will provide a better understanding of the history and prehistory of the area.

Combined. Construction of the power station and construction and operation of the mine will have both beneficial and adverse impacts upon National Register eligible cultural resources. Sites will be destroyed and this represents an irreversible commitment of a nonrenewable resource. This undertaking represents a total loss of any cultural resources sites which occur in areas to be disturbed within the project boundary, however, information will be retrieved that will expand our current knowledge of the history and prehistory of the area. A Memorandum of Agreement (MOA) is in the process of being drafted between the EPA, the SHPO and the Advisory Council on Historic Preservation in compliance with Section 106 of the National Historic Preservation Act (NHPA). The intent of the MOA will be to avoid or minimize project-related adverse impacts on cultural resources. During the course of ground disturbing activities, potential project-related adverse impacts on significant cultural resources will be coordinated with the SHPO of Texas.

5.13 AIR QUALITY

5.13.1 Existing Environment

5.13.1.1 Climatology

The proximity of the project site to the Gulf of Mexico, approximately 320 km (200 mi) to the southeast, greatly influences local climatology. The climate of the project area is a transition between humid subtropical areas to the south and east, and semi-arid steppes to the west. The regional climate can be summarized as subtropical with dry winters and humid summers.

Climatological characteristics of the project area have been determined from available data representative of east-central Texas. Care has been taken to choose climatic data sources representative of the project area, considering proximity, terrain and distance to the Gulf of Mexico.

Temperature. The annual average temperature for the project area is 19.2° C (66.5° F), based on data collected during 1954-1974 at the National Weather Service (NWS) cooperative station in Athens, 19 km (12 mi) to the northeast (U. S. Dept. of Commerce, 1981). Average monthly temperatures range from 8.7° C (47.7° F) in January to 28.8° C (83.9° F) in July. The highest temperature on record at Athens is 43.3° C (110° F) (August 1969), and the lowest is -12.8° C (9° F) (January 1963).

Precipitation. Rainfall is generally abundant for the area, with most monthly averages exceeding 7.6 cm (3 in.) (U. S. Dept. of Commerce, 1967). Most of the precipitation, both in quantity and number of occurrences, falls from convective showers. Heavy short-duration rainfalls resulting from thundershowers occur frequently during the April through September period. Heavy rains may also be associated with squall lines during spring or fall months. Rains of longer duration are normally the result of warm or stationary frontal activity to the south of the area during the colder months or are associated with dissipating tropical weather systems during summer or fall.

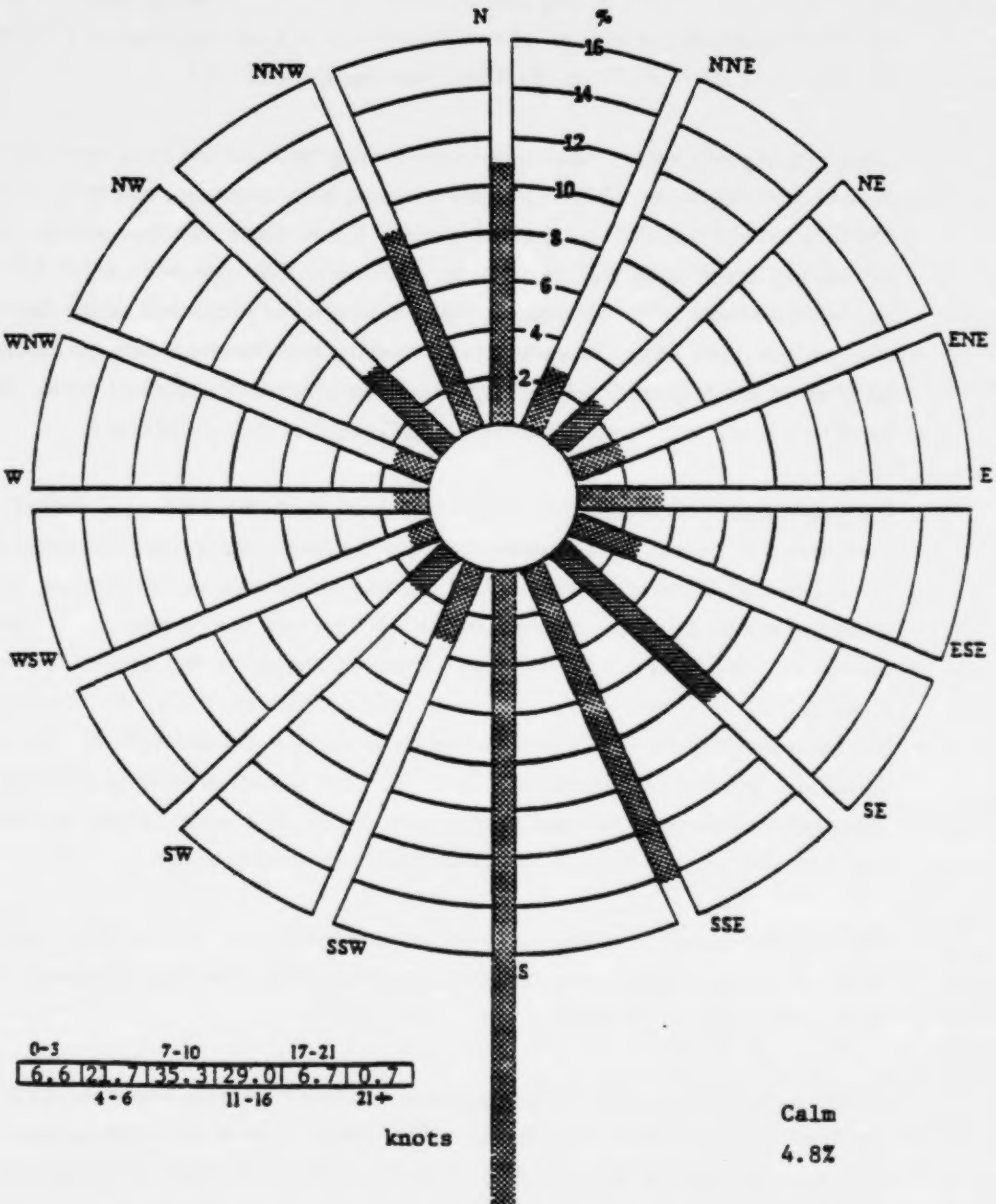
Data from the 1951-1980 period of record at Athens reveal an annual average precipitation rate of 100.18 cm (39.44 in.) (U. S. Dept. of Commerce, 1981). Monthly means range from 3.99 cm (1.57 in.) during July to 12.98 cm (5.11 in.) during May. A record annual maximum precipitation amount of 143.2 cm (56.39 in.) was measured in 1957, and a record minimum amount of 61.93 cm (24.38 in.) was measured in 1963.

Snowfalls of measurable amounts are rare, averaging about one occurrence per year in the project area (Baldwin, 1973). Moderate snows have occurred, however, as in February, 1968, when 8.9 cm (3.5 in.) fell at Athens (U. S. Dept. of Commerce, 1967). Such infrequent snows bias the mean data, such that they are not useful for determining expected amounts. For this reason, mean data are not presented here. Sleet does occur more often than snow, however, but amounts and durations are generally small. In addition to sleet, glaze (freezing rain) can also occur in the project area. Sleet or icing conditions occur most frequently from mid-December to mid-February.

Surface Winds. Based on the 16-point compass from the 1969-1973 period at Waco, the most frequent annual wind direction is from the south, occurring 28.5 percent of the time (U. S. Dept. of Commerce, 1975). The seasonal percentage occurrences of the south wind direction are 40.2 percent during summer, 24.7 percent during winter, 24.7 percent during spring, and 24.4 percent during fall. South-southeast is the second-highest occurring direction on an annual basis, occurring 14.2 percent of the time. The least frequent annual wind direction is west-southwest, occurring 1.1 percent of the time. Calm conditions prevail 4.8 percent of the time. The annual frequency distribution of wind direction is presented as wind rose in Fig. 5-12. The wind radials for each direction represent the percent of time the wind blows from that direction.

The windiest season is spring, with an average speed of 5.9 m/sec (13.1 mph). Winter is the next windiest season, followed by summer and fall. The annual average wind speed at Waco is 5.2 m/sec (11.6 mph).

Relative Humidity. The annual average relative humidity, based on data collected at the NWS station in Waco during 1964-1970, varies from a low of 54 percent at 6:00 p.m. CST to a maximum of 80 percent at 6:00 a.m. CST (U. S. Dept. of Commerce, 1970). The lowest relative humidities typically occur during the midafternoon hours, especially in the summer and fall; while the highest typically occur during the pre-dawn hours, most noticeably in the spring.



MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-12

ANNUAL WIND ROSE
FOR
WACO, TEXAS
(1969-1973)

Fog. The most frequent season for fog formation is midwinter, and the least frequent is summer. Based on a 34-year period of data records from the NWS station at Waco, December and January are the months having the most occurrences of heavy fog (visibility 0.4 km (0.25 mi) or less) with three days each (U. S. Dept. of Commerce, 1977).

Severe Weather. Severe weather in north-central Texas results from the occurrence of decaying tropical storms and large thunderstorms (including tornadoes). During the coldest months, ice storms may occur, but are infrequent events. Remnants of hurricanes and lesser tropical storms may affect the project area during June through October. Severe thunderstorms, with accompanying hail and tornadoes, may occur during any month of the year, but are generally limited to spring and early summer. In the project area, maximum thunderstorm activity usually occurs in the afternoon and evening hours.

Dispersion Meteorology. The primary meteorological factors which characterize the dispersion of air pollutants in the project area are surface winds, atmospheric stability, mixing layer heights and transport winds, and the frequencies of stagnating anticyclones and low-level inversions. Surface winds were discussed earlier.

Thermal and mechanical turbulence in the atmosphere act to disperse air pollutants. Conditions which promote turbulence and vertical mixing and thereby promote pollutant dispersion are referred to as unstable. Stable conditions inhibit dispersion. Neutral conditions are those which are considered to neither promote nor inhibit "normal" dispersion. A method for estimating the degree of turbulence (i.e., stability) in the surface layer of the atmosphere is used by the National Climatic Center (NCC) to produce a computer summary of stability conditions for selected NWS stations. The summary is called STAR (STability ARray) and has been obtained for Waco for the period 1969-1973. This information on the frequency of occurrence of certain stability conditions for a given wind speed and direction is useful for estimating the relative dispersive capacity of the atmosphere in the project area.

On an annual average, unstable conditions (classes A, B and C), are estimated to occur 17.3 percent of the time. The most frequently occurring class is D or neutral, occurring 54.6 percent of the time. Stable conditions, classes E and F, are estimated to occur 28.3 percent of the time (U. S. Dept. of Commerce, 1975).

The mixing layer is the layer of air next to the earth's surface through which relatively vigorous turbulent mixing occurs. The height and mean wind speed (transport wind) of this layer determine the volume into which pollutants will eventually be mixed. Holzworth (1974) analyzed worst-case annual and seasonal values of mixing heights and transport winds for 62 U. S. stations. The nearest station analyzed to the project area was Shreveport, Louisiana, 217 km (135 mi) to the east-northeast. Shreveport consistently ranked high in the absence of extended periods with poor dispersion.

Strong atmospheric stability resulting from a temperature inversion limits vertical dispersion of pollutants beneath or within the inversion. Inversions occur when the atmospheric temperature increases with height, and are most frequent during the late night and early morning hours. Hosler (1961) has estimated the frequency of occurrence of low-level inversions below 152 m (500 ft). In the project area, the frequency of low-level inversions in percent of total hours varies from 19 percent in the summer to 38 percent in the fall. The annual frequency of low-level inversions is 28 percent.

Maximum concentrations of air pollutants also often occur at ground level during periods of anticyclone (high-pressure system) stagnation. A study by Korshover (1971) indicates that the project area experienced a total of approximately 50 stagnation days and 10 stagnation cases (four or more continually stagnant days) during a 40-year study period.

Based on the preceding information pertaining to atmospheric stability, mixing heights, inversions and stagnating anticyclones, the project area can be characterized by atmospheric conditions favorable for the satisfactory dispersion of air pollutants.

5.13.1.2 Air Quality

Inventory of Point Emission Sources in the Project Area. There are currently few major point emission sources of atmospheric pollutants operating within a 50-km (31-mi) radius of the project site. The largest individual point source of sulfur dioxide (SO_2), total suspended particulates (TSP), and oxides of nitrogen (NO_x) currently operating in the region is Texas Utilities' Big Brown power plant, located approximately 40 km (25 mi) south of the proposed Malakoff EGS site. The Big Brown plant emits 3,140 g/sec (109,062 tons per year (tpy)) of SO_2, 330 g/sec (11,452 tpy) of TSP, and 692 g/sec (24,020 tpy) of NO_x. There are no other large point emission sources in the area. However, there are five small NO_x sources within approximately 10 km (6 mi) of the project site. Their emission rates are generally smaller than 30 g/sec (1,000 tpy) each (Radian, 1982). The Dallas-Fort Worth area, located approximately 100 km (62 mi) to the northwest, lies outside the area of impact of the Malakoff EGS and is the only major metropolitan area in proximity to the proposed site.

In addition to existing sources in the area, several sources are either under construction or permitted to construct, but are not yet in operation. The largest permitted source in the vicinity is the Texas Utilities' Forest Grove EGS, to be located approximately 11 km (7 mi) northeast of the proposed Malakoff EGS. This source is permitted to emit 1,194.0 g/sec (41,506 tpy) of SO_2 and 696.5 g/sec (24,212 tpy) of NO_x. Three gas processing plants are the only other sources permitted to construct within 30 km (19 mi) of the proposed Malakoff EGS site.

Ambient Air Quality in the Project Area. The region surrounding the project area is primarily rural. The dispersed nature of regional emissions and the distances to major industrial areas make the air quality generally good in the project area.

HL&P presently operates a monitoring station at Malakoff, which is collecting data for TSP, SO_2 and nitrogen dioxide (NO_2). Within the past three years, HL&P has also collected similar monitoring data from stations at Teague (60 km (37 mi) south-southwest), Fairfield (50 km (31 mi) south), and Jewett (85 km (53 mi) south-southwest). All SO_2, NO_2 and TSP concentrations measured at the various stations have remained well below the National Ambient Air Quality Standards (NAAQS) (Radian, 1982). Table 5-29 presents a summary of these data, and includes the NAAQS for each pollutant and averaging time. The NAAQS shown are primary standards, except where flagged as secondary standards. Primary standards are designed to protect the public health, while secondary standards are designed to protect the public welfare with an adequate margin of safety.

The project site is within an area designated attainment or unclassified for all EPA criteria pollutants. The nearest Prevention of Significant Deterioration (PSD) class I area is Caney Creek National Wilderness Area in Arkansas, approximately 280 km (174 mi) to the northeast.

TABLE 5-29

AMBIENT AIR MONITORING SUMMARY FOR HL&P STATIONS[a]

Station	Monitoring Period	SO_2 Annual Mean	SO_2 24-Hour 2nd Highest	SO_2 3-Hour 2nd Highest	TSP Annual Geometric Mean	TSP 24-Hour 2nd Highest	NO_2 Annual Mean
Malakoff	1/82-5/82	1.6	24.5	78.0	29.4	110	9.0
Teague	9/79-12/80	2.9	52.1	199.6	30.0	104	6.7
Jewett	9/79-12/80	1.1	17.3	72.0	27.1	98	5.1
Fairfield	1/78-12/78	2.2	25.6	126.6	27.9	98	3.2
Fairfield	1/79-8/79	1.9	37.1	182.3	29.5	87	3.9
NAAQS		80	365	1,300[b]	75	150[c]	100

a. All values in micrograms per cubic meter ($\mu g/m^3$).

b. Secondary standard.

c. Secondary standard. Primary standard is 260 $\mu g/m^3$.

Source: Radian, 1982.

5.13.2 Impacts of No Action Alternative

With the possible exception of future construction and operation of other facilities proposing to emit large quantities of atmospheric pollutants, the project area's air quality will remain unchanged from its present condition if the proposed project is not constructed. If industrial development does occur in the project area, the NAAQS could become constrained at some future date. The greatest potential air quality problem would be encountered if two or more major industrial facilities attempt to site adjacent to one another. Such future sources would be limited to prevent exceedances of the NAAQS or violations of any other existing or future air pollutant regulations.

5.13.3 Impacts of Project Alternatives

5.13.3.1 Impacts of Construction

Power Station. Pollutant emissions resulting from preparation of the power station site, construction of the Malakoff EGS and construction of transportive systems will cause some air quality impacts in the area immediately surrounding the construction activity. These impacts will be short term and localized, and air pollution levels will only occasionally exceed normal background levels as a result of construction.

On-site open burning during clearing activities will be minimized. All controlled burning will adhere to State, Federal and local regulations. Burning will be conducted during the hours of the day designated for such procedures and under meteorological conditions that will allow for burning in a safe manner (TACB I, Rule III.2(2)). Debris resulting from clearing and grubbing activities will be stockpiled to facilitate access to and control of burning. These materials will be left to dry for variable periods of time before burning; time of burning will be determined by dryness of the piles. Workers and equipment will be on site during burning operations. Burning operations and safeguards will be designed to minimize adverse impacts on surrounding areas and wildlife habitats.

Some exhaust will also be produced by the operation of diesel engines and by construction activities such as welding. Other vehicular exhaust emissions will include small amounts of carbon monoxide, hydrocarbons and oxides of nitrogen. These mobile source emissions are not expected to result in an exceedance of any Federal or State standard.

On-site fugitive dust will result primarily from heavy earth-moving equipment involved in excavation of fill material and from vehicular traffic on unpaved roads. Fugitive dust consists predominately of large particles which settle quickly, pose minimum adverse health effects, and have worst-case impacts under different conditions than those associated with stack emissions. During construction, sprinkler trucks will be employed on the roadways and in immediate construction areas periodically to mitigate surface dusting conditions. The moderately high frequency of occurrence of precipitation at the plant site area will further reduce the presence of fugitive dust. Emissions will be controlled so that they will not cause or intensify any traffic hazard due to impairment of visibility on nearby public roads.

Mine. As with construction of the power plant, some fugitive dust emissions will be produced by construction of mine support facilities. Any adverse air quality impacts will be temporary and localized, and air pollutant levels will only occasionally exceed normal background levels as a result of facility construction.

On-site open burning from clearing activities will be minimized. All controlled burning will adhere to applicable State, Federal and local regulations. Burning will be conducted during the hours of the day designated for such procedures, and under meteorological conditions that will allow for burning in a safe manner. Debris resulting from clearing and grubbing activities will be stockpiled to facilitate access to and control of burning. Men and equipment will be on site during burning operations. Burning operations and safeguards will be designed to minimize undesirable effects on adjacent areas and wildlife habitats.

Combined. The combined impacts of construction of the proposed power station and mine on air quality will be an increase in fugitive dust during the time when both construction projects are at peak activity. However, any potential adverse impacts associated with construction-related dust emissions will be intermittent and of short duration.

5.13.3.2 Impacts of Operation

Power Station. The proposed Malakoff EGS will have the potential to emit in excess of 100 tpy of each of the following air pollutants: SO_2, NO_2, TSP and carbon monoxide (CO). Because of this, the proposed Malakoff EGS will be a "major point emission source," as defined in State and Federal regulations. All Prevention of Significant Deterioration of Air Quality (PSD) preconstruction permitting requirements (including those pertaining to ambient air quality monitoring) must be met and a PSD permit must be obtained under 40 CFR 52.21 before construction of the proposed generating station may begin.

The proposed Malakoff EGS will also emit beryllium, mercury and sulfuric acid mist at rates in excess of Federally defined significance levels. The ambient impacts of the emissions will be evaluated as part of the PSD permitting process and a PSD permit will not be granted unless it is demonstrated that these impacts are within allowed levels. There is no National Emission Standard for Hazardous Air Pollutants (NESHAP) promulgated under 40 CFR 61, which will be applicable to the proposed generating station. Regulated pollutants, other than those mentioned above, will be emitted either at negligible rates or not at all.

Impacts of Stack Emissions. The stack emission rates are to be limited by the New Source Performance Standards for fossil fuel-fired steam boilers. The Best Available Control Technology (BACT) proposed for the generating unit will conform with the applicable NSPS. Emissions of SO_2 will be controlled by a wet limestone flue gas desulfurization system, TSP emissions will be controlled by electrostatic precipitators, and NO_x emission control will be accomplished by the use of a specific boiler burner design and the use of controlled combustion. Controlled combustion will also be utilized in the control of CO emissions.

The Malakoff EGS Good Engineering Practice (GEP) stack heights have been calculated to be 195 m (640 ft) using procedures defined by the EPA and are based on the dimensions of the boilers (292 ft high by 232 ft wide). The design stack height will be 190 m (625 ft). The design stack height is less than three percent lower than the calculated GEP stack height and is therefore sufficient to ensure that emissions from the stacks will not result in excessive pollutant concentrations nearby as the result of aerodynamic downwash.

To determine the future impact of the proposed plant's emissions on ambient air quality, a comprehensive dispersion modeling analysis was performed using EPA-approved models. An annual modeling analysis, using the Texas Climatological Model (TCM-2), was conducted to determine the annual average impacts of SO_2, NO_2 and TSP. Short-term SO_2 and TSP impacts were determined in a separate analysis, using the Texas Episodic Model (TEM-8). Ground level concentrations of CO were determined by use of the PTPLU model. Detailed descriptions of the modeling techniques are contained in the document, An Air Quality Analysis for the Malakoff Electric Generating Station (Radian, 1982). The maximum predicted annual, 24-hour, and 3-hour SO_2 concentrations from the Malakoff EGS alone were 3.7, 19.8 and 215.1 $\mu g/m^3$, respectively. The maximum predicted annual (geometric mean) and 24-hour TSP concentrations were 1 and 4 $\mu g/m^3$, respectively. The maximum predicted annual NO_2 concentration was 2 $\mu g/m^3$. The maximum predicted 1-hour and 8-hour CO concentrations were both 69 $\mu g/m^3$. The TSP and CO values were all below significance levels, so no further analyses were performed on them. However, the SO_2 and NO_2 values were analyzed further, to determine cumulative impacts when combined with emissions from other point emission sources in the project area (see Sec. 5.13.3.3 for a discussion of cumulative impacts).

Impacts of Non-Criteria Pollutant Emissions. No established regulatory standard presently exists for ambient concentrations of beryllium, mercury or sulfuric acid mist. To assess the significance of the impact of these pollutants, predicted ambient concentrations were compared to the threshold limit value (TLV) for each pollutant as published by the American Conference of Governmental Industrial Hygienists. The TLV is a maximum recommended 8-hour average concentration for worker exposure. It is based on a continuous long-term exposure during a 40-hour work week. The maximum predicted ambient concentrations for beryllium, mercury and sulfuric acid were 0.0008 percent, 0.002 percent and 2.5 percent, respectively, of the TLV's (Radian, 1982). Since these predicted ambient concentrations will occur infrequently, and are low compared to a long-term recommended exposure rate, no significant risk to public health is expected.

Impacts of Fugitive Emissions. In addition to stack emissions, there will be fugitive dust emissions from lignite and limestone transport, processing and storage operations. These emissions were evaluated and were found to have an insignificant contribution when compared to boiler emissions. All reasonable air pollution control measures will be undertaken to prevent fugitive dust from becoming airborne. These measures will constitute BACT and include the use of water sprays, enclosing of transfer points, and the use of filter bag dust collectors and partially enclosed conveyors.

There will also be fugitive emissions of several pollutants from vehicular activity. These emissions will be small and are not expected to cause or even approach an exceedance of any Federal or State ambient air quality standard.

Impacts of Radioactive Emissions. The potential health effects associated with stack releases depend upon the radionuclide concentrations in the lignite, the amount of lignite burned, and the amount of fly ash released from the stack. The annual radionuclide emission rates for the proposed units are listed in Table 5-30. The most direct pathway for human exposure is inhalation of radioactive aerosols directly from the plume. Other pathways such as deposition on or uptake into surface water, food plants or animals are considered trivial compared to the direct pathway (Beck, 1980).

Table 5-31 compares normal background levels with the maximum annual average ground-level concentrations resulting from the continuous operation of the units at full load. The operation of the lignite units will contribute only a minor fraction of the existing ambient concentrations of airborne radionuclides. It follows that foliar deposition and surface-water contamination due to the plume will be minimal.

Virtually all of the non-gaseous radionuclides originally contained in the lignite will reside in permanent solid waste disposal areas after the lignite is burned. The fly ash will be mixed with the scrubber sludge prior to final disposal. The reestablishment of Rn-222 equilibrium would require only one month, provided that there was little opportunity for radon to escape from the ash. If the average ash content of the lignite fuel is approximately 25 percent, then the concentrations of the radionuclides in the ash will be about four times the concentrations found in the raw lignite. However, according to Beck et al. (1980), fly ash is relatively resistant to both leaching and radon release due to emanation. The reduction of the mobility of radioactive materials within the ash is caused by the conversion of the ash content in the lignite during burning into a highly insoluble glassy substance. Less than one percent of the radon contained in the ash is expected to be emanated. In addition, the concentrations of the radionuclides in the mixed scrubber sludge and fly ash will be less than the concentrations in the fly ash alone.

Vegetation and Soils. Vegetation varies widely in its susceptibility to SO_2 injury. Effects depend upon species and physiological and environmental conditions. One study (EPA et al., 1976) indicates that sensitive vegetation such as alfalfa, peas, oats, etc., can tolerate SO_2 exposures up to 2,489 $\mu g/m^3$ for one hour, 1,441 $\mu g/m^3$ for two hours, or 917 $\mu g/m^3$ for four hours. Moderately tolerant species of trees, shrubs and grasses like those typically found in the project area can tolerate exposures at much higher levels than these threshold injury values. Since the maximum calculated ambient SO_2 concentration from the modeling analyses was 562 $\mu g/m^3$ (3-hour), no significant impacts on grasses,

TABLE 5-30

ANNUAL NUCLIDE EMISSION RATES FROM UNITS 1 AND 2

Nuclide	Uncontrolled Throughput[a] (Ci/Y)	Controlled Emission[b] (Ci/Y)
Uranium-238	24.3	0.0340
Thorium-230	24.3	0.0340
Radium-226	24.3	0.0340
Radon-222	24.3	24.3[c]
Lead-210	24.3	0.0340
Polonium-210	24.3	0.0340
Thorium-232	5.05	0.0071
Thorium-228	5.05	0.0071
Radium-228	5.05	0.0071

Note: A measured uranium-238 concentration of 8.0 ppm_w and an assumed thorium-232 concentration of 5.0 ppm_w in the lignite were used to estimate their respective emission rates, while the emission rates for the other nuclides listed were estimated based on the assumption of secular equilibrium.

a. Assuming 10.1 million tons of lignite/year. The unit curie, Ci, is defined as 3.7×10^{10} disintegrations per second.

b. Assuming 99.86 percent fly ash removal efficiencies for both Units 1 and 2.

c. Assuming no collection of radon gas prior to release to the atmosphere.

TABLE 5-31
ESTIMATED MAXIMUM ANNUAL GROUND-LEVEL CONCENTRATIONS, AMBIENT BACKGROUND LEVELS, AND MAXIMUM PERMISSIBLE CONCENTRATIONS

Nuclide	Units 1 and 2 Maximum Annual Ground-Level Concentrations[a] (aCi/m^3)	Background Concentrations[b] (aCi/m^3)	Maximum Permissible Concentrations[c] (aCi/m^3)
Uranium-238	1.45	100 - 400	50,000,000
Thorium-230	1.45	45	3,000,000
Radium-226	1.45	80 - 100	60,000,000,000
Radon-222	1,035	100,000,000- 500,000,000	10,000,000,000
Lead-210	1.45	10,000	80,000,000
Polonium-210	1.45	1,000	70,000,000
Thorium-232	0.30	30	4,000,000
Thorium-228	0.30	30	2,000,000
Radium-228	0.30	N.A.	10,000,000

Note: atto, a, is 10^{-18}.

N.A. - Not Available.

a. Based on EPA-approved annual dispersion modeling techniques.

b. From NCRP-45 (1975).

c. From National Bureau of Standards Handbook 69 (1959). The Maximum Permissible Concentrations (MPCs) listed are for continuous occupational exposure. The Federal Radiation Council (1960) recommends that exposure to the general public be restricted to less than or equal to one tenth of the occupational MPCs in air.

shrubs and trees are anticipated. Also, no adverse impacts are expected on less sensitive plants like corn.

The aforementioned study (EPA et al., 1976) also indicated that very little impact will be observed due to the exposure of vegetation to NO_2 at concentrations of up to 720 $\mu g/m^3$ (annual average). The annual average NO_2 value obtained from the modeling analyses was 18 $\mu g/m^3$, far below the threshold value at which sensitive plant species may be affected. Thus, no adverse impacts are anticipated on the less-sensitive vegetation found in the project area.

Visibility. Visibility degradation in the immediate vicinity of the proposed power plant is expected to be minimal. The presence of NO_2, TSP and moisture within the boiler stack plumes may cause slight reductions in local visual range and apparent contrast. However, because no significant scenic vistas are located near the project area, the impact of these small visibility reductions will be insignificant. A visibility analysis performed for the Malakoff EGS air quality report (Radian, 1982) showed that emissions from the plant will not adversely impact the nearest PSD Class I area, Caney Creek National Wilderness Area in Arkansas, 280 km (174 mi) distant.

Acid Deposition. Acid deposition is a controversial issue of concern in the midwestern and northeastern U. S. The electric utility industry is actively involved in researching virtually all facets of the acid deposition issue. The Electric Power Research Institute has an extensive research program underway on the cause and effects of acid deposition. Individual utilities and utility groups are funding research on the acid rain issue. The Utility Air Regulatory Group, working with the Edison Electric Institute, has formed an Acid Deposition Task Force to aid the industry in addressing the issue. In Texas, acid deposition has not been a major issue in the past, but because of concern elsewhere, has recently been addressed in a study by the Texas Energy and Natural Resources Advisory Council (EH&A, 1982i). This study was part of the development of a statewide plan to determine the validity and extent of any acid deposition problem in Texas. The plan, one of very few such plans in effect in the nation, notes that Texas is, in general, resistant to the effects of acid deposition and that an acid deposition problem is unlikely in the immediate future.

Cooling Tower Impacts. Fog produced by the cooling tower may occur during atmospheric conditions conducive to the formation of natural fog. In general, the cooling tower may slightly increase the duration and density of naturally occurring fog. Although the cooling tower continually adds water vapor to the air, the atmosphere will generally accept this vapor without producing significant fog unless the atmosphere is already near saturation and capable of forming natural fog. This occurs most frequently during the nighttime and early morning hours, when the atmosphere has cooled to its dewpoint temperature and saturation has occurred. Icing from the cooling tower may occur when atmospheric water droplets come in contact with objects that are at temperatures below freezing. Such occurrences will be infrequent, as minimum temperatures below 0° C (32° F) at the NWS Cooperative station in Athens are reported only 33 days per year on the average (U.S. Dept. of Commerce, 1981). Icing from the transport and dispersion of water vapor results in very little accumulation on horizontal surfaces such as highways. Icing of the soft rime variety may occur, however, on vertical surfaces such as tree trunks and transmission towers. Even though freezing temperatures occur periodically in the project area, the occurrence of icing from the cooling tower operation is expected to be insignificant.

Transportive Systems Impacts. Lignite from the mine will be delivered to the power plant by a combination of trucks and conveyors. Limestone for the SO_2 emission control system will be brought to the plant by rail. As addressed in the impacts of fugitive emissions section, there will be some fugitive dust generated in the transport operations. These emissions will be effectively controlled as previously stated. In addition, there will be some diesel exhaust emissions from the railroad vehicles. The impacts of these emissions are expected to be negligible.

Mine. The operation of the proposed Trinity lignite mine will cause particulate matter to be emitted into the atmosphere. Most of the proposed emissions will be fugitive in nature, and will be composed primarily of large particles which settle out of the atmosphere within a short time and distance from where they originate.

Impacts of Processing Emissions. Lignite processing facilities at the mine will be minimal. There will be no crushing or beneficiating facilities in operation on site. Two feeder breakers, used to reduce the size of the lignite for conveyor handling, and their associated transfer points will be the major emitters of process particulate matter. Based on information supplied by the applicant, total controlled lignite processing emissions from truck unloading, lignite breaking, lignite conveying and live storage will range from 0.63 g/sec (21.8 tpy) to 1.56 g/sec (54.0 tpy), dependent on alternatives to be selected, at the annual average operating capacity of the handling facility. This total is far less than the minimum cutoff point for PSD applicability (7.20 g/sec (250 tpy)). Control technology to be applied at the various lignite processing points will include: enclosure of the breakers below grade, 3/4 covered conveyors, application of water spray at the truck unloading point, use of a fabric filter at the silo loading point (if a silo is selected), and wet suppression of the live storage pile (if above ground live storage is selected).

Impacts of Fugitive Emissions. The proposed Trinity lignite mining operation, consisting primarily of removal and replacement of large amounts of overburden material, and of the removal, haulage and storage of lignite, will generate fugitive dust. However, because the emissions from the mine will be intermittent and spread over a large area, and because significant particle settling will occur very close to each source, air quality impacts are expected to be minimal.

Some of the anticipated control measures to be used to mitigate the impact of fugitive dust emissions from the mine will include: wet suppression of storage piles and haul roads, control of vehicle speeds, and thorough revegetation of all disturbed areas.

Impacts of Radioactive Emissions. Trace amounts of uranium and thorium are present in the lignite, primarily as uranium-238 (U-238) and thorium-232 (Th-232), respectively, along with some 28 decay series' products. Analyses of the lignite which is proposed for use by the Malakoff EGS indicate that an average value of 8.0 ppm_w of uranium-238 is present in the fuel (Core Laboratories, Inc., 1982). Thorium-232 was not analyzed, but a conservative value of 5 ppm_w may be considered representative, based on typical lignite deposits in this region of northeast Texas.

Radon-222 (Rn-222), a decay series radionuclide of U-238, will be released into the atmosphere as a result of mining operations at the proposed mine. Radon-222 is normally emanated continuously from virgin undisturbed topsoil. The amount of Rn-222 emanated is related to the amount of U-238 present in the soil or the near-surface material being excavated. The emanation rate is also related to the type and form of material. The radon emanation ratio (ratio of escape to production rate) is approximately 15 percent for coal and up to 70 percent for soils (Beck et al., 1980). Other factors which influence the radon emanation rate of materials are moisture content (higher moisture contents reduce emanation) and porosity (the greater the porosity, the more able radon released at larger depths can reach the surface and be emanated). Soils have been reported to have an average concentration of U-238 of 1.8 ppm_w (NCRP, 1975). The emanation rate of Rn-222 resulting from exposure of lignite seams during mining operations and storage of lignite at an emanation ratio of 15 percent would not be expected to be greatly different from the average soils at an emanation ratio of 70 percent. Therefore, release of Rn-222 by the exposed lignite during mining operations is not expected to be significant.

The concentrations of U-238 and Th-232, and their associated decay series' radionuclides, vary by both horizontal and vertical locations within overburdens (Rosholt et al., 1966; University School of Public Health et al., 1982). The actions of mining and land reclamation will have the effect of relocating various layers of overburden material containing different amounts of these radionuclides. The Rn-222 emanation rate from the surface at some locations in the reclaimed mine area will be less than the predisturbed emanation rate, while at other locations in the reclaimed mine area, it will be greater. These changes in the radon emanation rate will be caused by relocating existing pockets of overburden material containing varying contents of radium-226 (Ra-226), the parent nuclide of Rn-222, and by changes in topsoil and overburden porosity.

Vegetation. Dust from surface mining operations can be expected to occasionally produce a nuisance condition near the mine boundary. Dust particles will settle on vegetation, potentially reducing its attractiveness. Dust control measures applied at the mine should minimize any potential adverse effects of fugitive dust on vegetation.

Visibility. Locally reduced visibility due to fugitive dust from mining operations, in conjunction with dry, windy atmospheric conditions, may occur near the project area. However, the relatively large size of the fugitive particles will promote their rapid deposition from the atmosphere within a short distance.

Combined. Operation of the proposed Malakoff EGS and Trinity Mine, located in adjacent sites, will impact the ambient TSP concentrations of the project area. However, the maximum TSP impacts from the mine and plant operations will not generally coincide. Mining operation emissions (fugitive dust emitted at ground level) will occur at the mining area and will decrease rapidly with distance. Fine particle emissions from the power plant boiler stacks will impact at greater distances downwind. Because impacts will generally not be coincident, no combined adverse TSP impacts are anticipated.

Radon-222 (Rn-222) will be released into the atmosphere as a result of mining operations. The release of Rn-222 during mining operations would not be expected to be greatly different from average soils. Following reclamation, the Rn-222 emanation rate will be less than the predisturbed rate at some locations, while at other locations in the reclaimed mine area, it will be greater. The operation of the lignite units will contribute only a minor fraction of the existing ambient concentrations of radionuclides.

A secondary air quality impact from the combined power plant mine operations will be an increase in atmospheric pollutant emissions due to local population growth. Operation of the Malakoff EGS and Trinity Mine will require approximately 1,107 permanent employees. A significant portion of this work force will be made up of individuals, some with families, who will move to Malakoff and surrounding communities. However, the overall impact will not pose any threat to the NAAQS and will likely not even be detectable.

The power station and the mine will each have a minor impact on the local meteorology of the area. The primary impact from the power plant will be the development of fog above and downwind of the cooling tower during humid, stable conditions. The primary impact from the mine will be the potential of locally reduced visibility due to blowing dust during dry, windy conditions. Therefore, combined project-related meteorological impacts will be minor, as the impacts of each operation generally occur during dissimilar atmospheric conditions.

5.13.3.3 Cumulative

A dispersion modeling study was performed to determine the cumulative impacts on regional air quality from the proposed Malakoff EGS, as well as from any existing PSD point emission sources in the area (Radian, 1982).

In this study, the modeled SO_2 and NO_2 concentrations from the Malakoff EGS were added to the modeled impacts from other PSD increment consuming sources in the project area, then were added to the representative ambient (monitored) air quality in the area. Impacts from baseline point emission sources, as well as from existing PSD sources, are represented in the ambient air quality. The maximum concentrations are considered conservative in that the analysis used resulted in "double-counting" of the impacts of some sources. All sources which commenced operation after the baseline date, but before the monitoring began, are accounted for in both the monitoring data and the modeling analysis. Also, for short-term modeling, the meteorological conditions which resulted in the highest monitored concentrations will not necessarily be the same as the meteorological conditions which resulted in the highest concentrations from the modeled sources. The resulting values were then compared to the NAAQS. For SO_2, the maximum impact occurred with the 3-hour averaging period, where the highest predicted concentration was 562 $\mu g/m^3$, or 43 percent of the NAAQS. The predicted SO_2 concentrations for the 24-hour and annual averaging times were 99 $\mu g/m^3$ and 7 $\mu g/m^3$, respectively. The predicted NO_2 annual average was 18 $\mu g/m^3$, or 18 percent of the NAAQS. Cumulative impacts modeling for TSP and CO were not conducted, since their modeled values for the Malakoff EGS by itself were below significance levels.

The proposed Trinity Mine will be primarily a fugitive TSP source. Its impact was not included in this analysis, since it is not significantly impacted by the Malakoff EGS TSP emissions. In general, the cumulative impacts of lignite mining operations, when combined with the impacts from major point emission sources, are very small.

Cumulative impacts of radioactive emissions from the Malakoff EGS and the other regional power plants and surface lignite mines are not expected to be significant. Power plant emissions (gases and particulate matter emitted at stack-top level) will have a maximum annual impact within 5 km (3.1 mi) of the stacks. Mining operation emissions will impact at points immediately adjacent to the mining area and will decrease rapidly with distance. The greatest cumulative impacts from all the sources will be found close to the individual sources and will be attributable almost entirely to those individual sources. The increases in the existing radionuclide concentrations resulting from the operation of the individual power plants and mines are expected to be small and will become much smaller with distance.

5.14 NOISE

Neither the State of Texas nor Henderson or Anderson counties have promulgated noise regulations limiting maximum noise levels from power plant or surface mine operations. As directed by Congress in the Noise Control Act of 1972 and amended by the Quiet Communities Act of 1978, EPA has developed appropriate noise level guidelines. EPA generally recognizes rural areas to have an average day-night noise level (L_{dn}) of less than 50 dBA (EPA, 1978). L_{dn} is the 24-hour equivalent sound level with the nighttime

(10:00 p.m. to 7:00 a.m.) sound level penalized by the addition of 10 dBA. Average outdoor noise levels in excess of 55 dBA for 24 hours are considered annoying for some persons, while levels of 70 dBA or more for 24 hours can result in hearing loss (EPA, 1974). EPA has developed guidelines for an immediate goal L_{dn} of 75 dBA, a short-term goal L_{dn} of 65 dBA and a long-term goal L_{dn} of 55 dBA for noise levels outside of structures such as buildings, residences, etc. (EPA, 1977). For residences, the U. S. Dept. of Housing and Urban Development (HUD) considers an outdoor L_{dn} of 65 dBA or less to be "acceptable." Levels above 65 dBA and not exceeding 75 dBA are considered "normally unacceptable," and levels above 75 dBA are "unacceptable" (HUD, 1980).

5.14.1 Existing Environment

The major noise sources in the project area are distributed over an area in excess of 259 km^2 (100 mi^2) and represent: general activities from the area's major population centers; railroad traffic along the St. Louis-Southwestern track; and motor vehicle noise from U. S. Highway 287, TX Highway 31, and Farm Roads 59, 90 and 753 (Fig. 5-13). Representative noise levels were computed for each source using currently accepted techniques for determining community, traffic and railroad noise. There are no major industries or airports within effective distance of the proposed Malakoff EGS/Trinity Mine Project site (EH&A, 1982j).

Day-night noise levels for communities can be computed (National Research Council, 1977) using the equation: L_{dn} = 10 log rho + 22dB, where rho is population density in people per square mile. The area's major population centers and their corresponding L_{dn} were found to be: Athens, 53 dBA; Malakoff, 52 dBA; and Trinidad, 42 dBA. For each of these communities, calculated noise levels fall within the HUD acceptability limit of 65 dBA for residential areas (EH&A, 1982j).

Railroad noise levels were calculated using the techniques provided by the Noise Assessment Guidelines (HUD, 1980) and based upon data gathered from railroad dispatchers. The St. Louis-Southwestern Railroad operates on the average 15 trains daily, containing approximately 75 cars each. The day-night noise level for the area was found to be 79 dBA at 30.5 m (100 ft) from the track bed. Assuming a line source attenuation rate of 4.5 dBA per doubling of distance from the track (Transportation Research Board, 1976) an L_{dn} of 65 and 55 dBA would be attained beyond 254 and 10,016 m (832 and 32,861 ft), respectively (EH&A, 1982j).

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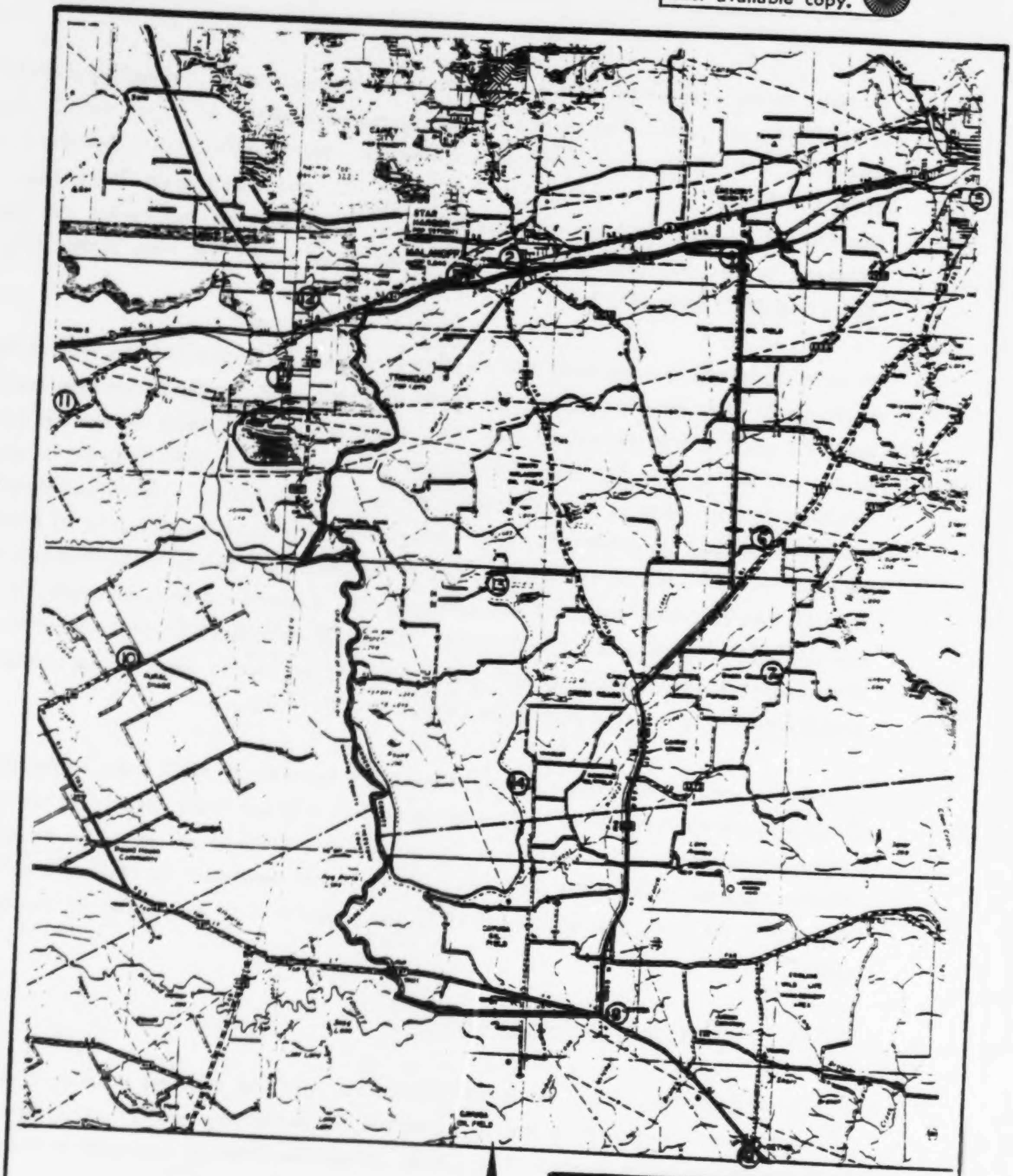

STAR HARBOR
MALAKOFF
TRINIDAD
PROJECT BOUNDARY
⑭ NOISE RECEPTOR LOCATIONS
0 1 2 3 4 5 10
Kilometers
0 1 2 3 4 5 6 7
Miles
N

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-13

NOISE RECEPTOR LOCATIONS

No noise measurement data were available for pertinent sections of the roadways near the project area, so traffic characteristics and accepted methods of motor vehicle noise prediction were employed to estimate traffic noise. Motor vehicle noise was quantified using the FHWA Noise Predictor Model, SNAP 1.0, and based upon Texas Highway Department average 24-hour traffic data for 1979. SNAP 1.0 results for the major roadways in the study area and show all roadway noise to be less than 55 dBA beyond 244 m (800 ft) (EH&A, 1982j).

In order to describe adequately the existing sound quality in the general project area, noise levels have been estimated for noise sensitive locations (i.e., churches, schools, hospitals, etc.) around the project area. The previously discussed noise sources are typical of the site survey area; but due to the area's rural nature, any specific point is usually affected by only one or two of the noise sources mentioned. Using hemispherical radiation analysis techniques, day-night noise levels have been projected to 14 baseline receptor locations around the project area. These receptors include eight churches, four schools, two community centers and one hospital. Figure 5-13 provides their relative positions with respect to the project area. Table 5-32 describes each of the locations and provides levels contributing to the background ambient sound level at each location. Levels were found to range from 31 to 68 dBA (EH&A, 1982j).

In summary, project area day-night noise levels are expected to range from approximately 31 dBA in purely rural areas to as high as 68 dBA in those areas heavily influenced by motor vehicle and railroad activities. Day-night noise levels at all receptors, except the Kilman Hospital in Malakoff (68 dBA) and the church southwest of Malakoff on Texas Highway 31 (68 dBA), fall within the HUD acceptability limit of 65 dBA for residential areas.

5.14.2 Impacts of No Action Alternative

Higher traffic volumes on the area's major roadways and railways in association with general population growth in the area could increase highway and railway traffic along with community noise levels by 1 to 2 dBA. Otherwise, little or no change in the project area's baseline ambient sound level is anticipated with the no action alternative.

TABLE 5-32
PROJECTED AMBIENT SOUND LEVELS AT BASELINE RECEPTOR LOCATIONS

Site	Description	L_{dn} (dBA)
Location 1	School in Trinidad along FM 764.	60
Location 2	Kilman Hospital in Malakoff along TX Hwy 31.	68
Location 3	Church in southwest Malakoff along TX Hwy 31.	68
Location 4	Church in Midway along TX Hwy 31.	67
Location 5	Angeline Junior College in Athens.	59
Location 6	Willow Springs Church approximately 11.2 km (7 mi) southwest of Athens along FM 59.	61
Location 7	Becks Chapel approximately 14.5 km (9 mi) southwest of Athens 3.2 km (2 mi) east of FM 59.	31
Location 8	Church and post office in Cayuga along U.S. Hwy 287.	63
Location 9	Community Hall in Bethel along U.S. Hwy 287.	62
Location 10	Church and school in Rural Shade along FM 635.	51
Location 11	Church and community hall in Samaria along FM 3096.	55
Location 12	School in Trinidad along FM 1667 north of TX Hwy 31.	59
Location 13	Rural non-residential site approximately 7.2 km (4.5 mi) south of Malakoff and 2.6 km (1.6 mi) west of FM 90.	48
Location 14	Two churches approximately 8 km (5 mi) northwest of Cayuga and 3.1 km (1.9 mi) west of FM 59.	51

5.14.3 Impacts of Project Alternatives

5.14.3.1 Impacts of Construction

Noise-producing site preparation and construction activities at the Malakoff EGS/Trinity Mine Project can be categorized into two basic activities: power plant construction and mine facilities construction. Typical major noise-producing sources and the equivalent sound level contribution (L_{eq}) during each activity are estimated from data published by both the Edison Electric Institute (EEI) and EH&A.

Power Station. The construction of the power plant facilities is considered to be similar to the construction of an average industrial facility. The use of such equipment as backhoes, bulldozers, scrapers and dump trucks during clearing and excavation related to site preparation will constitute the noisiest period of construction. Railway and vehicular traffic will also contribute to construction noise levels. The equivalent sound level (L_{eq}) during this period is estimated to be 84 dBA at 15.2 m (50 ft) from the center of activity. Further, foundation finishing and structure erection noise levels may result in short-term increases in overall noise levels when these jobs are performed simultaneously with excavation and land clearing at adjoining facility sites.

The construction of the railroad spur, transmission line, makeup water pipeline and discharge pipeline will occur during the initial phases of the project. Equipment such as backhoes, cranes, graders and scrapers will be involved in all aspects of the transportative systems' construction. The equivalent sound level of railroad construction and each of the other construction activities is estimated to be 84 dBA and 82 dBA at 15.2 m (50 ft) from their noise centers, respectively. All phases of the transportative system's construction have the potential of occurring within proximity of each other, in which case an increase in overall noise levels will be experienced.

When considering the effects of construction activities on local ambient sound levels, "worst case" conditions are assumed to occur occasionally when activities are performed simultaneously and within proximity to each other. Increased noise levels at the plant site, as well as along the transportative rights-of-way, will be somewhat attenuated by existing topography and vegetation. It is anticipated that under "worst-case" conditions, increased noise levels associated with construction activities will be short term and have no significant, adverse affect on local residences.

Mine. Noise levels associated with the construction of the mine's ancillary facilities (i.e., shop and personnel facilities, dragline erection yard, etc.) and haul roads will be similar to the levels produced at the power plant construction site. Hence, an equivalent sound level of 84 dBA can be expected at 15.2 m (50 ft) from the center of the mine facilities construction activities, though construction in the mine area will be of a shorter duration and more spread out than at the power plant site. As with the power station, increased noise levels at the mine facilities construction site will be somewhat attenuated by existing topography and vegetation and it is anticipated that under worst-case conditions, increased noise levels will be short term and have no significant, adverse affect on local residences.

Combined. Construction activities at the proposed plant and mine will be carried out at various sections of the combined project's 23,616-ha (57,600-ac) area. The mine ancillary facilities construction area will occupy approximately .32 km^2 (283 ac) of the total project area and the proposed power plant will occupy 1.6 km^2 (400 ac). Thus, only a small percentage of the total acreage will be involved in the noise-producing activities during the construction period of the mine facilities and the power plant. The pieces of noise-producing equipment used on the two sites are sufficiently distant from each other and of such a nature that the combined effects, during the period when construction of the power plant and mine are occurring simultaneously, are not measurably different from the individual effects. Traffic flow along the area's roadways will increase slightly and will result in only minor contributions to the ambient noise levels.

5.14.3.2 Impacts of Operation

Power Station. Noise-producing operations of the proposed power plant facility can be categorized into three separate activities: power production, lignite handling and limestone handling. These activities can occur simultaneously and will be confined to an area of approximately 1.1 km^2 (272 ac).

The noise assessment for the proposed power plant is based on twin 600 MW units operating on a 24-hour per day basis. The major noise-producing equipment associated with power production operations are: the two boilers, eight induced draft fans, and the two turbine generators. Noise levels were determined for each piece of equipment at a distance of 15.2 m (50 ft) with enclosure attenuations of 10 to 30 dBA considered for applicable equipment (EEI, 1978).

Lignite will be delivered to the power plant by belt feeders and conveyors which will carry the lignite through the transfer house to the crusher house. Conveyors will then transfer lignite to the in-plant silos, active storage pile or the emergency stackout system. The principal noise producing equipment associated with lignite handling operations are: receiving hoppers, transfer towers, active reclaim silos and sample crushers. Enclosure attenuation was once again considered where it was applicable for various lignite handling operations (reclaim silo, transfer tower and crusher house) (EEI, 1978).

Limestone will be brought in by rail, unloaded into a hopper and conveyed to the fully-enclosed limestone pile for storage. The primary noise-producing equipment associated with limestone handling operations are the receiving hoppers and the trains. Limestone deliveries will not occur on a daily basis, hence, the contribution to the power station's overall operation noise level is negligible.

For a "worst-case" condition, it can be assumed both power production and lignite handling will occur simultaneously. Typically, peak lignite handling activities will occur during portions of the day, while power production will occur on a 24-hour per day basis.

An acoustic center can be determined for the proposed power station using a procedure provided by the Edison Electric Institute (EEI, 1978). Once the acoustic center is located, it can be considered a point source with an attenuation rate of 6 dBA per doubling of distance from the noise source. The acoustic center was found to be near the administration building and to have an L_{dn} of 91 dBA, with noise levels calculated at a distance of 15.2 m (50 ft) from each piece of equipment. Noise levels will be within the immediate EPA goal of 75 dB at approximately 97 m (318 ft) from the acoustic center. The short-term goal of 65 dB and the long-term goal of 55 dB are anticipated to be met beyond 307 m (1,008 ft) and 975 m (3,200 ft), respectively, from the source.

The greatest potential noise impacts will generally occur when power production coincides with peak coal and limestone handling operations. The estimated operational ambient L_{dn} at each of the baseline receptors is shown in Table 5-33. The table includes the receptors' background ambient sound level and represents the "worst-case" sound levels during operational activities. Sound level contributions from the operational activities were extrapolated from their respective centers of activity to the baseline locations using hemispherical sound radiation analysis. The assumption of hemispherical radiation does not include attenuation due to foliage and ground absorption and is, therefore, conservative.

TABLE 5-33
ESTIMATED POWER STATION OPERATIONAL AMBIENT SOUND LEVELS AT BASELINE RECEPTORS

Location[a]	Background Ambient Sound Level[b] (dBA)	Operational Sound Level (dBA)	Expected Ambient Sound Level (dBA)	Change in Ambient Sound Level (dBA)
	L_{dn}	L_{dn}	L_{dn}	
1	60	42	60	0
2	68	41	68	0
3	68	44	68	0
4	67	34	67	0
5	59	30	59	0
6	61	33	61	0
7	31	31	34	3
8	63	28	63	0
9	62	26	62	0
10	51	32	51	0
11	55	34	55	0
12	59	43	59	0
13	48	38	49	1
14	51	32	51	0

a. Figure 5-13.

b. Reference: EH&A, 1982.

By combining the baseline receptor ambient sound level with the power station's operational sound level, each receptor's expected ambient sound level (L_{dn}) was computed (Table 5-33). Locations 7 and 13 (Fig. 5-13) show a marginal increase of 3 and 1 dBA, respectively, while all other receptors reflect no change. The proposed plant's "worst-case" day-night sound levels are not anticipated to exceed EPA's long-term goal L_{dn} of 55 dBA at any of the baseline receptor locations. Day-night sound levels are expected to range from 45 to 54 dBA along the property line of the power station.

In summary, the results of Table 5-33 show that baseline receptors will experience no significant noise impacts. "Worst-case" L_{dn}'s affecting the baseline receptors are expected to range from 26 dBA to 44 dBA. This results in an almost negligible increase of the existing ambient sound levels adjacent to the project area. Areas further away will experience no impacts. In general, the area's existing baseline ambient sound level is not expected to be significantly impacted by power station operations.

Mine. Noise-producing operations of the proposed mine can be categorized into four separate activities: timber and brush removal; surface soil and overburden removal; lignite mining; and spoil grading and revegetation. These activities can occur simultaneously, however, spread out over an area of over 62 km^2 (24 mi^2). The impacts of these activities upon ambient sound levels within the project area are discussed in this section.

Timber and brush within a mine block will be removed prior to mine operation startup. Trees and brush will be felled using chain saws and/or bulldozers. Timber will be loaded onto dump trucks for transportation from the mine block. Typical equipment and their sound levels at 15.2 m (50 ft) (EPA, 1977) include: bulldozer, 82 dBA; chain saw, 78 dBA; loader, 78 dBA; and dump truck, 78 dBA. An L_{eq} of 85 dBA at 15.2 m (50 ft) from the center of activity is expected to occur during this phase.

Overburden will be removed and stockpiled by use of either dragline, power shovel, scrapers or bucket wheel excavator. Regardless of the primary excavation method used, satellite equipment will include: haul truck, 88 dBA; bulldozer, 82 dBA; grader, 85 dBA; and loader, 78 dBA. Overburden removal is anticipated to occur on a 24-hour per day basis within an L_{eq}/L_{dn} contribution at 15.2 m (50 ft) for each excavation method of: dragline, 92/98 dBA; power shovel, 93/99 dBA; scrapers, 97/103 dBA; and BWE, 91/97 dBA.

A hydraulic excavator (backhoe) will be used to remove lignite in the pit. The lignite will be loaded directly into 64-metric ton (70-ton) bottom dump trucks which will travel from the pit to a conveyor loading facility. Typical equipment and their sound levels at 15.2 m (50 ft) (EPA, 1977) include: backhoe, 82 dBA; bottom dump trucks, 88 dBA; loading hopper, 78 dBA; and feeder breaker, 83 dBA. The sound level contribution associated with lignite loading will be substantially lower due to the depth of excavation. In effect, the pit walls will act as noise barriers, attenuating up to 15 dBA per pit (Transportation Research Board, 1976). This noise reduction will not occur for lignite handling operations since those operations will take place outside the pit. Lignite loading and handling are anticipated to occur on a 24-hour per day basis with handling operations being the loudest activity. Lignite handling is expected to have an L_{eq} contribution at 15.2 m (50 ft) of 90 dBA (L_{dn} 96 dBA) while lignite loading will have an L_{eq} of 71 dBA and an L_{dn} of 77 dBA (with a 15 dBA pit wall attenuation).

Overburden regrading and revegetation (reclamation) will be generally concurrent with mining. Typical equipment and their sound levels at 15.2 m (50 ft) will include: bulldozers, 82 dBA; graders, 85 dBA; and large trucks, 88 dBA. The L_{eq} contribution during this period is estimated to be 88 dBA at 15.2 m (50 ft) from the center of activity.

Based on a "worst-case" scenario (overburden removal using scrapers) with all mine operations occurring simultaneously and within proximity to each other, day-night sound levels are anticipated to be within the immediate EPA goal of 75 dBA at approximately 387 m (1,269 ft) from the center of mining activity. The short-term goal of 65 dBA and the long-term goal of 55 dBA are anticipated to be met beyond 1,229 m (4,031 ft) and 3,901 m (12,800 ft), respectively, from the source.

The greatest potential for noise impacts will generally occur when mining operations (primarily overburden removal) progress along the perimeter of the project area. The estimated operational ambient day-night sound level (L_{dn}) at each of the baseline receptors is shown in Table 5-34. The table includes the receptor's background ambient sound levels and presents the "worst-case" sound levels during operational activities. Sound level contributions from the operational activities were extrapolated from their respective centers of activity to the baseline locations using hemispherical sound radiation analysis techniques. The assumption of hemispherical radiation does not include attenuation due to foliage and ground absorption and is, therefore, conservative.

TABLE 5-34
ESTIMATED MINE OPERATIONAL AMBIENT SOUND LEVELS AT BASELINE RECEPTORS

Location[a]	Background Ambient Sound Level[b] (dBA)	Operational Sound Level (dBA)	Expected Ambient Sound Level (dBA)	Change in Ambient Sound Level (dBA)
	L_{dn}	L_{dn}	L_{dn}	
1	60	52	61	1
2	68	62	69	1
3	68	67	71	3
4	67	64	69	2
5	59	47	59	0
6	61	60	64	3
7	31	54	54	23
8	63	70	71	8
9	62	49	62	0
10	51	50	54	3
11	55	46	56	1
12	59	51	60	1
13[c]	48	--	--	--
14[d]	51	--	--	--

a. Figure 5-13.

b. EH&A, 1982.

c,d. On-site receptor locations - omitted for impact assessment.

Receptor locations 13 and 14 (Fig. 5-13) reflect on-site, existing noise receptors which will be removed after the startup of mining operations. Therefore, these locations will not be considered in the impact assessment. The Trinity Mine's worst-case, day-night sound levels are not anticipated to exceed EPA's short-term goal L_{dn} of 65 dBA at all receptor locations except 3 and 8 (67 and 70 dBA, respectively). An increase in the ambient sound level of 3 dBA would occur at the Kilman Hospital (receptor 3) while a change of 8 dBA would be expected at Cayuga (receptor 8). The greatest increase in ambient sound level (23 dBA) based on mining operations was found to occur at the Beck Chapel. However, the new ambient sound level (54 dBA) will remain below EPA's long-term goal L_{dn} of 55 dBA.

Studies undertaken to review the case histories of community response to intruding noise indicate the following (EPA, 1974):

Sound Level Increase	Expected Community Response
0 to 5 dB	No observed reaction
5 to 10 dB	Sporadic complaints
10 to 15 dB	Widespread complaints
15 to 25 dB	Threats of community action
More than 25 dB	Vigorous community action

It should be emphasized that the operational ambient sound levels shown in Table 5-34 reflect the maximum worst-case L_{dn} for mining operations clustered immediately adjacent to the nearest pit's boundary. With operations occurring toward the center of the mine, sound levels will decrease to near the baseline level beyond the project boundary. The increases in the ambient sound level associated with mining activities will not have a significant impact on noise sensitive receptors in the area. Any impacts will be localized, of relatively short duration, and attenuated with distance from the source.

Combined. The combined effects of operational noise from the proposed power station and mine are additive in that noise-producing activities will occur simultaneously. However, the overall size of the combined site (233 km^2 (57,600 ac)) and orientation of the respective operations on their individual sites (particularly the transient nature of mining operations) are such that noise impacts will not be greater for the combined sites than for the independently operating sites.

5.14.3.3 Cumulative

Cumulative noise impacts associated with other projects in the area are not anticipated in the Malakoff EGS/Trinity Mine area due to the distance between projects. Topography and ground cover also tend to reduce cumulative noise levels between project areas.

5.15 POPULATION

5.15.1 Existing Environment

Between 1940 and 1970, the project area experienced steady population losses largely due to the nationwide rural-to-urban migration. By 1970, population growth became evident as the lake areas in the region began to develop, and smaller Texas cities exhibited increasing levels of in-migration. Major population centers in the three-county area include Athens, Corsicana, Palestine, Malakoff and Trinidad, all of which experienced recent population growth (Table 5-35). Smaller communities in proximity to the project site include Cross Roads and Cayuga.

5.15.2 Impacts of No Action Alternative

Taking into account 1980 Census data and 1960-1970 and 1970-1980 economic trends, "without project" population projections indicate steady growth for the three-county area. By the year 2000, Henderson County is projected to increase to an estimated 73,000 people, Navarro County to 43,000 and Anderson County to 59,000. This projected growth represents a 50 percent population increase in the project area.

5.15.3 Impacts of Project Alternatives

5.15.3.1 Impacts of Construction

Increased employment opportunities will result in the growth of the project area's population over "without project" levels through in-migration of workers and their families. Construction of the proposed project is scheduled to occur within a six-year time period, with Malakoff EGS construction workers on site in late 1983 and full operation of both the Malakoff EGS and the Trinity Mine in January 1989. The initial

TABLE 5-35

HISTORICAL POPULATION TRENDS, 1940-1980

	1940	1950	1960	1970	1980	Percent Change 1970-1980
Texas	6,414,824	7,711,194	9,579,677	11,198,655	14,228,383	27.1
Henderson County	31,822	23,405	21,786	26,466	42,606	61.0
Athens	4,765	5,194	7,086	9,582	10,197	6.4
Malakoff	N.A.	N.A.	N.A.	2,045	2,082	1.8
Trinidad	N.A.	N.A.	N.A.	1,079	1,130	4.7
Cross Roads	N.A.	N.A.	N.A	N.A.	150-300	--
Navarro County	51,308	39,916	34,423	31,150	35,323	13.4
Corsicana	15,232	19,211	20,344	19,972	21,712	8.7
Anderson County	37,092	31,875	28,162	27,789	38,381	38.1
Palestine	12,144	12,503	13,974	14,525	15,948	9.8
Cayuga	N.A.	N.A.	N.A.	682	607	-11.0

N.A.: Not Available.

Source: U. S. Department of Commerce, 1962, 1971a, 1981.
Pass, 1979.

construction work force will consist of 357 Malakoff EGS employees in 1983 and 40 Trinity Mine employees in late 1984. The combined project peak employment will occur in 1986 with an average of 3,248 workers. Construction employment will then decrease as the project approaches operation in 1989, at which time approximately 300 construction workers will be required (Table 5-36). Major skills needed for project construction include engineers, heavy equipment operators, carpenters, iron workers, electricians, pipefitters and general laborers.

The construction work force will be comprised of local residents (within 48 km (30 mi) of the project site) as well as those workers who will in-migrate to the local area and/or commute (i.e., from Tyler, southeast Dallas or other areas within a 80-km (50-mi) radius). It is anticipated that local workers will provide approximately 20 percent (650 positions) of the needed peak construction work force. An estimated 55 percent (1,786 positions) of the work force will consist of in-migrants with the remaining 25 percent (812 positions) being commuters. This labor distribution is based upon the extent of skilled and unskilled workers in the local area as well as the commuting distance of the larger urban centers to the project site that may be a source of contract labor. Employment in the three-county project area is largely concentrated in manufacturing, trades and services, with the construction sector accounting for less than 10 percent. However, with rising unemployment rates, there is likely to be a number of persons available for work although not specifically skilled for project construction.

It should also be noted that due to the variable nature of project construction schedules during both the planning phase and site construction, the actual distribution of workers involved in regional construction projects is difficult to determine. Because East Texas is a prime region for energy development, there is the potential that the degree of in-migration for the proposed project may be less than estimated due to the release of construction workers from another project.

Based upon energy employee family characteristics developed by Denver Research Institute (1979), approximately 60 percent of energy-related construction workers are married with an average family size of 3.55 persons. Therefore, during peak construction employment in 1986, the in-migrating primary work force of 1,786 will result in a peak population influx of 4,520 persons, as shown in Table 5-37. This total population influx is anticipated to consist of 1,643 households and 382 school-age children. The secondary population influx is estimated at 200 persons, comprised of 20 school-age children and 62

TABLE 5-36
MALAKOFF EGS/TRINITY MINE CONSTRUCTION WORK FORCE

Month/Year	Malakoff EGS	Trinity Mine	Total
10/83 - 12/83	357	0	357
1/84 - 6/84	1,025	0	1,025
7/84 - 12/84	1,614	40	1,654
1/85 - 6/85	1,950	40	1,990
7/85 - 12/85	2,302	40	2,342
1/86 - 6/86	2,846	100	2,946
7/86 - 12/86	3,148	100	3,248
1/87 - 6/87	2,785	160	2,945
7/87 - 12/87	1,775	160	1,935
1/88 - 6/88	1,208	160	1,368
7/88 - 12/88	488	160	648
1/89 - 6/89	140	160	300
7/89 - 12/89	52	160	212
1/90 - 6/90	0	100	100
7/90 - 12/90	0	10	10

Source: HL&P, 1982c; NACCO, 1982c.

TABLE 5-37
CONSTRUCTION PHASE
POPULATION EFFECTS

Month/ Year	Total Construction Work Force[a]	In-Migrant Primary Workers[b]	In-Migrant Primary Population	In-Migrant Secondary Population	Total In-Migrant Population
10/83-12/83	357	196	497	22	519
1/84-6/84	1,025	564	1,426	63	1,489
7/84-12/84	1,654	910	2,302	102	2,404
1/84-6/85	1,990	1,095	2,769	123	2,892
7/85-12/85	2,342	1,288	3,259	144	3,403
1/86-6/86	2,946	1,620	4,099	181	4,280
7/86-12/86	3,248	1,786	4,520	200	4,720
1/87-6/87	2,945	1,620	4,098	181	4,279
7/87-12/87	1,935	1,064	2,693	119	2,812
1/88-6/88	1,368	752	1,904	84	1,988
7/88-12/88	648	356	902	40	942
1/89-6/89	300	165	417	18	435
7/89-12/89	212	117	295	13	308
1/90-6/90	100	55	139	6	145
7/90-12/90	10	6	14	1	15

a. Source: Table 5-36.

b. Based on assumed 55 percent in-migration.

households. According to a survey of energy-related in-migrants, typical newcomers to the area will have a median age of 22 years (Mountain West Research, Inc., 1975). The latest census data indicate that the three-county project area median age is approximately 34 to 36 years (U. S. Department of Commerce, 1971b). However, it is estimated that the new wave of in-migration to the area since 1970 has lowered this age, thus likely lessening the disparity between existing residents and in-migrants associated with the Malakoff EGS/Trinity Mine. Nonetheless, the younger in-migrant population will likely cause changes in the structure of local communities, which can be viewed either positively or negatively by existing residents.

A general indication of the potential distribution of the in-migrating population among the various project area communities was based upon a location ratio for each community as determined by current population, population growth rates and distance from the project site. These variables were chosen based on the assumption that an in-migrant's desire to live in a particular community is directly related to the community's distance from work and its relative amenities. Population and population growth rates were used as proxy variables for amenity levels.

According to the above methodology, Athens and Corsicana could each potentially capture 27 percent (1,274 persons) of the in-migrating population, while Malakoff could receive 21 percent (991 persons), Trinidad 12 percent (566 persons), Palestine 11 percent (519 persons), and the remainder distributed throughout the counties. Nonetheless, the ultimate in-migration distribution to the various communities will greatly depend upon actual housing and service availability.

The estimated 4,720 project-related population influx (4,520 primary and 200 secondary) will not cause a significant increase in the overall area population density. The location of the Malakoff EGS/Trinity Mine is such that workers could choose to reside in Athens, Malakoff, Trinidad or Corsicana, for instance, and still be within commuting distance.

It should be noted that this population influx represents a construction peak, and that it will not occur all at once in 1986 but rather build up gradually from 1983 and then decline through 1989. The staging of construction employment over a six-year period will aid in mitigating potential adverse impacts associated with overall in-migration.

The proposed transmission line will have minimal impact to the study area population because of the scarcity of residential dwellings. As a result of careful routing, no residents along the proposed route will be displaced. The nearest dwelling is projected to be approximately 150 to 210 m (500 to 700 ft) from the route. Minor inconveniences may result in areas where construction equipment must cross roads, temporarily disrupting traffic.

5.15.3.2 Impacts of Operation

Staffing of the operation and maintenance work force for the Malakoff EGS/Trinity Mine will begin in late 1984 to early 1985 and increase to a stable, long-term employment of 1,107 by 1997 (Malakoff EGS employment will stabilize at 622 workers in January, 1989, while mine employment will gradually increase to its peak of 485 by 1997) (Table 5-38). It is anticipated that local workers will provide approximately 20 percent (221 positions) of the needed long-term work force. Due to the shortage of skilled operations workers in the immediate area relative to the demand of the proposed project and another major energy project in the area, 80 percent (886 positions) of the peak operation/maintenance workers are expected to in-migrate. To the extent that rising local unemployment levels result in a significant number of workers available to fill those positions conducive to training, in-migration will be lessened.

No additional secondary jobs are anticipated to be created solely on the basis of operations workers, however, this stable long-term population will be able to support those jobs arising from construction employment. A portion of the secondary employment generated through the peak project employment during construction activities is expected to carry over into the long-term operations period. The larger in-migration associated with construction work will provide the initial impetus to secondary employment, however, the actual creation of most of the service-related jobs is not anticipated to occur until the more permanent population moves into the area and generates expanded economic activity.

During long-term project operation, the in-migrating primary work force of 886 will result in a peak population influx of 2,952 (Table 5-39). This population is expected to consist of 868 total households and 290 school-age children. The demographic structure of the project area is likely to change as the median age decreases and as the level of employment and median income associated with project in-migrants both increase. As

TABLE 5-38
MALAKOFF EGS/TRINITY MINE OPERATIONS WORK FORCE

Year[a]	Malakoff EGS	Trinity Mine	Total
1985	15	32	47
1986	75	42	117
1987	250	80	330
1988	500	182	682
1989	622	270	892
1990	622	315	937
1991	622	343	965
1992	622	345	967
1993	622	362	984
1994	622	384	1,006
1995	622	405	1,027
1996	622	411	1,033
Life of Project	622	485	1,107

a. Employment at mid-year.

Source: HL&P, 1982c; NACCO, 1982c.

TABLE 5-39
OPERATION PHASE
POPULATION EFFECTS

Year	Total Operations Work Force[a]	In-Migrant Primary Workers[b]	Total In-Migrant Population[c]
1985	47	38	125
1986	117	94	312
1987	330	264	880
1988	682	546	1,818
1989	892	714	2,378
1990	937	750	2,497
1991	965	772	2,572
1992	967	774	2,577
1993	984	787	2,623
1994	1,006	805	2,681
1995	1,027	822	2,737
1996	1,033	826	2,753
Life of Project	1,107	886	2,952

a. Source: Table 5-38.

b. Based on assumed 80 percent in-migration.

c. Secondary employment assumed to be met 100 percent from local labor force.

the number of younger families increases, services to meet their needs may also increase (i.e., retail, recreational and various leisure activity centers). Overall, the composition of population growth is not anticipated to generate significant, long-term, adverse impact.

Based upon the assumed in-migrant population distribution, Athens and Corsicana could each potentially capture 797 of the inmigrating operations population, Malakoff could receive 620 persons, Trinidad 354, and Palestine 325. The remaining 59 individuals would be distributed throughout the counties.

5.15.3.3 Impacts of Combined Operation and Construction

A five-year "overlap" period (1985-1990) exists during which both construction and operation personnel will be required. The combined work force is presented in Table 5-40. As shown in Table 5-40, a combined peak population of 5,159 in-migrants is projected in 1987. The resulting population distribution of in-migrants is presented in Table 5-41.

5.15.3.4 Cumulative

Another energy project is expected to undergo development in the three-county project area potentially within a similar time frame as the Malakoff EGS/Trinity Mine. The Forest Grove mine and power plant project is estimated to be approximately the same magnitude as the Malakoff project, and is located about 24 km (15 mi) to the east. Because no scheduling or employment estimates have been completed for Forest Grove, it is difficult to determine the project's actual contribution to a cumulative impact of developments in the three-county area. However, based upon assumptions utilizing Malakoff EGS/Trinity Mine Project requirements, some generalizations can be discussed.

Based upon an estimated 3,400 jobs associated with Forest Grove, of which 60 to 80 percent (2,000 to 2,700 jobs) would be filled by in-migrants, approximately 5,000 to 6,800 additional people could potentially move into the area. This population influx would consist of 1,800 to 2,400 households and 430 to 580 school-age children.

5.16 ECONOMICS

5.16.1 Existing Environment

Between 1975 and 1981, the labor force growth in the three-county project area averaged 23 percent compared to approximately 34 percent for the State. Reported 1981 local

TABLE 5-40
COMBINED PROJECT OPERATION AND CONSTRUCTION PHASE POPULATION EFFECTS

Year	Total Work Force	Total In-Migrant Population
1983	375	519
1984	1,654	2,404
1985	2,389	3,528
1986	3,365	5,032
1987	3,275	5,159
1988	2,050	3,806
1989	1,192	2,813
1990	1,037	2,642
1991	965	2,572
1992	967	2,577
1993	984	2,623
1994	1,006	2,681
1995	1,027	2,737
1996	1,033	2,753
Life of Project	1,107	2,952

TABLE 5-41
PROJECTED POPULATION DISTRIBUTION OF PROJECT-RELATED IN-MIGRANTS

Year	Malakoff	Trinidad	Athens	Corsicana	Palestine	Other	Total
1983	109	62	140	140	57	11	519
1984	505	288	649	649	264	49	2,404
1985	741	423	953	953	388	70	3,528
1986	1,057	604	1,359	1,359	554	99	5,032
1987	1,083	619	1,393	1,393	567	104	5,159
1988	799	457	1,028	1,028	419	75	3,806
1989	591	338	760	760	309	55	2,813
1990	555	317	713	713	291	53	2,642
1991	540	309	694	694	283	52	2,572
1992	541	309	696	696	283	52	2,577
1993	551	315	708	708	289	52	2,623
1994	563	322	724	724	295	53	2,681
1995	575	328	739	739	301	55	2,737
1996	578	330	743	743	303	56	2,753
Life of Project	620	354	797	797	325	59	2,952

unemployment rates ranged from 5.1 percent in Navarro County to 8.4 percent in Henderson County, averaging higher than the State 5.3 percent. The Tyler metropolitan area just to the east of the project area reported 5.5 percent unemployment. With the exception of Henderson County where unemployment rose by slightly more than one percent since 1975, current unemployment rates have improved and/or remained unchanged in the project area over the six-year period (Texas Employment Commission, 1976-1981).

The major economic sectors in the project area include manufacturing and trades, individually accounting for approximately 24 percent of local employment and 26 percent of total area income. Project area per capita income averaged $6,500 in 1978 representing 83 percent of the State per capita level.

5.16.2 Impacts of No Action Alternative

Various manufacturing and potential energy-related activities in the area enhance the likelihood of expanded employment opportunities in the near future. Occupational skills in the area indicate that the labor force is sufficiently skilled to meet a reasonable share of expanding employment needs, although increased energy development throughout the region will likely generate significant demand for a more skilled labor pool.

Personal and per capita income growth are directly related to employment growth, and should similarly follow expanding trends. Mining, manufacturing and trades and services are expected to be the major sources of personal income in the foreseeable future. Without the project, the regional growth in income, expected to be approximately $217 million annually during construction and about $103.9 million annually during the 35-year operations period, will not be realized.

5.16.3 Impacts of Project Alternatives

5.16.3.1 Impacts of Construction

Direct project construction employment is expected to support secondary or service employment in the region. Secondary employment arises from economic gains in trades and service industries, which either supply the project with materials and equipment or are affected by the spending of directly employed project personnel. Due to the transient nature of the construction work force, only a portion of worker income will be spent in the local area thereby reducing the overall secondary employment effects occurring in trade and service sectors. Accordingly, peak project construction activities in 1986 can potentially support approximately 1,900 secondary jobs in the local/regional economy. These include existing jobs within the current capacity of the various trade and service sectors, as well as new jobs created due to increased business investment. Any additional secondary jobs created in the local economy as a result of the proposed project are not anticipated to occur all at once, but rather build gradually as expanded economic activity becomes more observable in the operations period of the project.

Direct income benefits of the proposed project will include wages and salaries paid to construction workers and management personnel as well as the various capital expenditures. Total annual direct labor expenditures during peak construction are estimated at $127.8 million, of which $89.5 million is disposable income, the majority of which will be spent and invested directly in the project area economy. Capital expenditures (materials, equipment, power and fuels) over the full construction period are estimated at approximately $200 to $250 million (HL&P, 1982c; NACCO, 1982c).

Indirect income benefit to the local area resulting from construction worker consumer expenditure is estimated at $162.6 million. This total is based upon regional secondary income multipliers of 2.277 (power plant construction) and 1.955 (coal mining) (Golden et al., 1980c); an assumption that 75 percent of the construction workers will reside locally (existing residents plus project in-migrants); and a local expenditure capture rate of 75 percent. At the multi-county regional level, this income benefit increases to approximately $217 million.

5.16.3.2 Impacts of Operation

The distribution of long-term project employment is projected to be among the construction, service, transportation and utilities, retail trade and public service sectors. Over the long term, the project is expected to contribute to changing employment patterns by reducing unemployment and allowing lower income workers to move into higher paying jobs. Changes in the project area may in turn diversify the regional economy.

Income effects of operations activities will include direct income from wages/salaries and capital expenditures, as well as secondary income flow from increased consumer spending and expanded capital expenditures. Average annual labor expenditures are estimated at $26.4 million for the combined Malakoff EGS/Trinity Mine. Other operations and maintenance expenditures (i.e., materials, power and fuels, annual lease payments, clean up services) are estimated at $38.0 million. Such items as fuel, trash pick-up, pest control services and some materials are likely to be purchased on the local level. Indirect or secondary income benefit to the local area resulting from operations worker consumer expenditure is estimated at $29.5 million.

5.16.3.3 Cumulative

Based upon the general assumption that the Forest Grove project will require an employment level comparable to the Malakoff EGS/Trinity Mine, 4,200 energy-related jobs will be created in addition to the 4,355 associated with construction and operation of the proposed project. However, assuming that scheduling may allow a 15 to 20 percent level of employee transfer between the two projects, particularly construction workers, Forest Grove is anticipated to generate approximately 3,400 jobs (2,500 construction and 900 operations). The total cumulative impact of both energy projects is approximately 7,750 primary jobs during construction and operation.

Due to a shortage of skilled and unskilled workers in the local area relative to the demand of two major energy projects, it is expected that as much as 60 to 80 percent (2,000 to 2,700) of the jobs associated with the second of the two projects may need to be filled by in-migrants.

5.17 HOUSING

5.17.1 Existing Environment

Henderson County has the largest existing housing stock fairly distributed throughout the county. Athens accounts for only about 18 percent of the housing in Henderson County, whereas Corsicana and Palestine each represent 50 to 60 percent of the housing in their respective counties. All of the project area counties and cities have increased their housing supply since 1970. Residential growth in the cities averaged 16 to 22 percent, while overall housing growth in the counties varied from 20 percent in Navarro County to 105 percent in Henderson County.

According to the 1980 Census, there are 1,373 vacant units in the five major project area cities. At this point in time, there is no differentiation between the type of units (e.g., single-family, multi-family, mobile homes, or sale property and rental property) or the quality of units. Census data indicate that in 1970 approximately 16 percent of all housing in the three-county area was substandard, and more specifically, 41 percent of all vacant rental property was substandard. Therefore, not all of the 1,373 vacant units can automatically be considered desirable or even habitable.

Discussions with local realtors and review of city building permits further demonstrate the relative unavailability of housing in the project area. While new housing starts have been apparent in recent years, a considerable amount of demolition of substandard units has resulted in relatively small net gains in the housing inventory. Realtors emphasize that rental property is scarce and that most apartment units have waiting lists. Mobile home space is available in any of the mobile home parks in the project area (King, 1981; Butler, 1982).

5.17.2 Impacts of No Action Alternative

Housing availability varies among communities in the project area, although most cities are experiencing shortages. Building activity is expected to increase to accommodate energy development projects in the region. Rental property is foreseen as a high priority. However, any construction activity (single-family units or apartments) will be greatly dependent upon interest rates and financing arrangements.

5.17.3 Impacts of Project Alternatives

5.17.3.1 Impacts of Construction

Based upon the potential distribution of the in-migrating population, Athens and Corsicana are expected to receive the largest proportion of the 1,705 project-related new households. Accordingly, each of these cities will need to provide 460 housing units, while Malakoff will face a demand for 358 new units, Trinidad 205 units, and Palestine 188 units.

Based upon surveys of worker housing preference (Denver Research Institute, 1979; Mountain West Research, Inc., 1975), the 1,705 project-related new households would require 784 single-family units, 153 multi-family units, 648 mobile homes and 120 other housing types. These figures of individual housing types are not to be assumed definitive, but rather a general indication of magnitude. At the present time, the project area cannot meet this housing demand. Although some construction has occurred in recent years, there have been no large housing developments to accommodate significant levels of population in-migration. As a result, housing demand of this magnitude represents a significant, adverse impact to the local area.

With the shortage of rental property compared to the relative availability of mobile home space, it is expected that larger numbers of workers will choose mobile homes particularly for the short-term construction period. However, extensive mobile home development may affect future land use patterns in the local communities. If land is divided to be used only for mobile homes, it will be difficult in the future to use the land for any other type of use. As a result, if desire for mobile homes decreases in the future, the land could become unused.

In anticipation of population growth associated with large-scale energy development, some of the local communities are in the process of compiling housing inventories in order to evaluate future need. Some apartment construction will likely start up prior to significant population in-migration in order to provide temporary accommodations. Without some initial steps to meet the increased demand, local communities may experience extensive mobile home development.

5.17.3.2 Impacts of Operation

Assuming 868 new households during project operation, Athens and Corsicana are each expected to face a demand for 234 housing units, Malakoff 182 units, Trinidad 104 units, and Palestine 95 units. The 868 new households during project operation will require 608 single-family units, 95 multi-family units, 148 mobile homes and 17 other housing types. Operations workers may experience less problems finding housing than the initial construction work force due to the expected turnover in housing stock as construction workers complete their jobs and move out of the area. However, this transfer will only be effective if adequate housing construction takes place over the energy project construction period. Overall, the housing impact during the operations phase is not anticipated to be as disruptive to local communities as that stemming from large-scale in-migration of construction workers.

5.17.3.3 Impacts of Combined Operation and Construction

As discussed in Sec. 5.15.3.3, an overlap in personnel staging will result in a total project-related peak in-migrant population of 5,159 individuals representing a total of 1,876 households. Athens and Corsicana will each need to provide 506 housing units, while Malakoff will face a demand of 394 new units, Trinidad 225 units and Palestine 206 units. As discussed in Sec. 5.17.3.1, new units will be required to meet demand.

5.17.3.4 Cumulative

The estimated 4,300 to 5,000 new households associated with two energy projects in the three-county area are projected to need approximately 3,067 single-family units, 552 multi-family units, 1,856 mobile homes and 316 other housing types.

5.18 COMMUNITY SERVICES AND FACILITIES

5.18.1 Existing Environment

Municipal potable water supply systems vary as to relative capacities to meet existing demands and comply with regulatory standards. In Corsicana, the largest city in the project area, current treatment capacity of 53.0 million liters per day (14.0 million gallons per day (mgd)) exceeds maximum daily use by approximately 13.2 million liters/day (3.5 mgd)), allowing for an estimated 2,666 connections (Table 5-42). Palestine utilizes just over half of its system treatment capacity of 38.3 liters per day (10.112 mgd), leaving sufficient surplus capacity to accommodate about 5,200 additional connections. Athens, with a system treatment capacity of about 10.8 million liters per day (2.85 mgd), reported a peak use of 10.18 million liters per day (2.69 mgd) in 1980. More recent data on average daily or maximum daily use has not been made available by the city; current use is assumed to equal or exceed capacity. The city continues efforts to add to its water treatment system capacity; local bond issues were defeated twice during 1982, however. The smaller communities of Malakoff and Trinidad have sufficient treatment capacities to accommodate additional connections, with surpluses of .67 million liters per day (.177 mgd) and 1.2 million liters per day (.324 mgd), respectively.

TABLE 5-42
MUNICIPAL WATER SUPPLIES

City	Source	Type of Treatment	Treatment Capacity (mgd)[a]	Ground Storage Capacity (million gallons)	Elevated Storage Capacity (million gallons)	Avg Daily Use (mgd)	Max Daily Use (mgd)	Population Served/ No. of Connections	Additional Capacity (No. of Connections)[b]
Corsicana	Surface: Lakes Halbert and Navarro Mills	Complete	14.0	8.32	1.65	6.5	10.5	22,000/8,000	2,666
Athens	Surface: Lake Athens	Complete	2.85	1.25	1.0	____[c]	____[c]	11,832/3,944	-0- Due to insufficient treatment capacity[d]
Malakoff	Ground: Carrizo-Wilcox Aquifer	Chlorination only	.750[e]	.35	.06	.250	.573	2,574/858	265
Trinidad	Surface: Cedar Creek Reservoir	Complete	.726	.5	.05	.136	.402	1,305/435	305[f]
Palestine	Surface: UNRMWA Ground: Carizzo-Wilcox Aquifer	Complete	10.112	3.8	.55	2.856	5.55	18,975/6,325	5,199
					Total Additional Capacity (No. of Connections)				8,435

a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

b. Additional capacity = $\dfrac{\text{(Treatment Capacity) - (Max. Daily Use)}}{\dfrac{\text{Max. Daily Use}}{\text{No. Connections}}}$

c. No recent data available; use is assumed to meet or exceed capacity, therefore no additional capacity is assumed to be available.

d. The City of Athens is expanding treatment facilities to double current capacity.

e. Malakoff does not have a treatment plant. Maximum well capacity = .75 mgd.

f. The City of Trinidad is negotiating to sell treated water to the City of Kerens.

Source: Texas State Department of Health, 1982.

Treatment capacity is not the only system parameter affecting expansion capacity. Texas Department of Health standards for public water systems require that distribution systems maintain minimum residual pressure of 20 pounds per square inch (psi) (35 psi under normal operating conditions); state standards also require, as a general rule, 200 gallons per connection of total storage capacity and 100 gallons per connection of elevated storage capacity. All project area municipalities report distribution system pressures of 40 psi or greater. The City of Malakoff's system currently provides inadequate elevated storage: state standards require 85,000 gallons of elevated storage, while the city system provides only 60,000 gallons. Similarly, the City of Palestine has a current elevated storage deficit of about 83,000 gallons. The City of Trinidad's system elevated storage capacity exceeds the state minimum standard by only about 6,000 gallons.

As shown in Table 5-43, existing wastewater systems in the project area municipalities also exhibit considerable variance with regard to expansion capacity. The Corsicana system demonstrates the largest growth capacity, based on an estimated excess flow capacity of 2.4 million gallons for both treatment plants. Over the 13-month review period shown in Table 5-43, the Corsicana system failed to meet state permit daily average discharge standards a total of 3 months for BOD and 4 months for TSS. The small cities of Malakoff and Trinidad also indicate surplus treatment capacity, based on excess flow capacities of .13 mgd and .19 mgd, respectively. Both cities' treatment systems reported minor exceedances of state BOD and TSS permit parameters over the review period. The cities of Palestine and Athens wastewater treatment systems appear to be operating at deficit capacities, based upon maximum reported flows and permit parameter noncompliance over the review period. Palestine is on the fundable portion of a federal grant to improve its overall wastewater treatment system. Athens has applied for federal funds to bring its system into compliance, but final authorization has not been received, and federal funding is scheduled to be reduced from the present 75 percent of the allowable construction cost of a wastewater treatment plant to 55 percent of the allowable construction cost, beginning on October 1, 1984.

Fire protection in the project area communities falls within the recommended standard of approximately one firefighter for every 700 persons or a minimum of 20 volunteer firefighters in communities with populations less than 10,000. The ratio of law enforcement officers to population in the project area ranges from 0.9 to 1.7 officers per 1,000 persons, slightly below the recommended level of two officers per 1,000 (Golden et al., 1980a; Texas Board of Insurance, 1981).

TABLE 5-43
MUNICIPAL SEWAGE TREATMENT FACILITIES

City	Type of Treatment	Design Flow (mgd)[a] Avg Daily Flow	Design Flow (mgd)[a] Max Daily Flow	Reported Flow (1981-1982)[b] Avg Daily Flow	Reported Flow (1981-1982)[b] Max Daily Flow	Excess Flow Capacity (mgd)[c]	Permit Non-Compliance Period
Athens[d]	01: Imhoff Trickling Filter	.90	1.8	.35	1.4		01: TSS daily average and 24-hr max exceeded every month in 1981 for which information is available
	02: Trickling Filter Oxidation Ponds	.92	2.2	1.047	4.35		02: Recent specific compliance unavailable.
		1.82	4.0	1.397	5.75	0	
Corsicana[g]	01: Activated Sludge	1.0	2.0	.663	1.75		01: BOD daily avg (20 mg/l permitted): 8/81 = 28.5 mg/l TSS daily avg (20 mg/l permitted): 8/81 = 21.0 mg/l 1/82 = 22.2 mg/l 3/82 = 24.0 mg/l TSS max 24 hrs (30 mg/l permitted): 11/81 = 40.0 mg/l
	02: Activated Sludge	3.5	8.75	3.14	6.0		02: BOD daily avg (20 mg/l permitted): 8/81 = 34.0 mg/l 11/81 = 28.43 mg/l TSS daily avg (20 mg/l permitted): 8/81 = 22.5 mg/l
		4.5	10.75	3.803	7.75	2.4	
Malakoff	Extended Aeration	.4	.8	.189	.642	.13	BOD daily avg (20 mg/l permitted): 4/82 = 36.0 mg/l TSS daily avg (20 mg/l permitted): 4/82 = 43.0 mg/l
Trinidad	Imhoff - Oxidation ponds	.15	.3	.037	.063	.19	BOD daily avg (30 mg/l permitted): 8/81 = 65.5 mg/l 9/81 = 40.5 mg/l 2/82 = 37.5 mg/l 3/82 = 38.0 mg/l TSS daily avg (90 mg/l permitted): 8/81 = 135.7 mg/l

TABLE 5-43 (Concluded)

City	Type of Treatment	Design Flow (mgd)[a] Avg Daily Flow	Design Flow (mgd)[a] Max Daily Flow	Reported Flow (1981-1982)[b] Avg Daily Flow	Reported Flow (1981-1982)[b] Max Daily Flow	Excess Flow Capacity (mgd)[c]	Permit Non-Compliance Period
Palestine[e]	01: Activated Sludge	.8	1.2	1.575	2.0		01: Avg. Daily Flow - exceeded all months 8/81 through 9/82 Max Daily Flow - exceeded 10/81, 11/81 and all months 2/82 through 9/82 BOD daily avg (20 mg/l permitted): Exceeded 9/81 and 1/82 through 9/82 TSS daily avg (20 mg/l permitted): Exceeded all months 8/81 through 9/82 (24-hr max and lb/day parameter exceedences occurred in same months as daily avg exceedences for both BOD and TSS)
	02: Imhoff - trickling filter oxidation ponds	1.5	3.0	1.18	2.02		02: Max daily flow 8/82 = 3.082 mgd TSS daily avg (20 mg/l permitted): 2/82 = 68.0 mg/l 4/82 = 54.0 mg/l (24-hr max and lb/day parameter exceedences for TSS occurred in same months as daily avg exceedences.)
		2.3	4.2	2.755	4.02	0[f]	

a. For metric unit equivalents, please refer to metric conversion table located in the Glossary.

b. Figures listed are based on the month of the highest reported daily flow during the period August 1981 through September 1982.

c. Excess capacity = (Permitted maximum daily flow - maximum daily flow) x 0.8.

d. Last reported data for Athens is 8/81. Athens has received a permit to increase flows at existing plant 01 and is in Step 1 of the grant process to request funds from EPA to expand treatment capacity.

e. Palestine is in Step 2 of the grant process to request funds from EPA to expand permitted avg daily flow from 0.8 to 2.05 mgd at plant 01, and from 1.2 to 4.5 mgd at plant 02. Trickling filter system is proposed to be replaced with oxidation pond and sludge drying bed system.

f. Due to non-compliance record, it was assumed for the purposes of estimating excess flow capacity for the City of Palestine that no excess capacity exists.

g. Corsicana has received a construction grant from EPA to expand its system to include a 1.0 mgd overland flow system. Facility expected to be on line in mid-1983.

Source: Texas Department of Water Resources, 1982.

Health facilities in the project area consist of three hospitals and several clinics with a combined hospital bed capacity of approximately 400. The overall doctor-population service ratio is within the Department of Health, Education and Welfare maximum standard of 1:1400 (Golden et al., 1980b; McIntyre, 1981; Summerlin, 1981).

Collectively, the five-project area school districts reported a 1980-81 enrollment of approximately 12,000 students with a teacher-student ratio averaging 1:31. Accepted ratios vary among states, however, generally recommended levels range from 1:20 to 1:27.

5.18.2 Impacts of No Action Alternative

Community facilities and services in the project area will expand as necessary to meet "without project" population projections to the extent that funds are available. Water and sewage systems are currently well below capacity levels in the five major communities. Police and fire protection are adequate for existing populations, and local communities foresee adding one or two personnel if significant population influxes occur. Medical and school facilities can accommodate a moderate increase in demand, although additional teachers are expected to be hired over the next several years, and hospital expansion needs are being evaluated particularly in Henderson County.

5.18.3 Impacts of Project Alternatives

5.18.3.1 Impacts of Construction

The estimated construction phase in-migrating population of 4,720 during peak construction activities will require approximately 2.77 million liters/day (0.732 mgd) of potable water supply, assuming an average consumption of 587 liters/capita/day (155 gallons per capita per day (gpcd)) (Chalmers and Anderson, 1977). Peak water consumption associated with this level of in-migration is estimated at 8.0 million liters/day (2.0 mgd), assuming peak demand as generally three times average use (Urban Systems Research and Engineering, 1980). Based on the assumed in-migrant population distribution among major communities discussed in Sec. 5.15.3.1, the 1,274 newcomers to the City of Athens will require 0.75 million liters/day (0.197 mgd). As detailed in Sec. 5.18.1, Athens' municipal water system is already experiencing difficulty in meeting current demands, and additional in-migration will further stress system capacity. Recent local bond issues to upgrade the city's water system have not been successful. The 1,274 construction-related in-migrants projected for the City of Corsicana are also expected to generate an incremental demand for about 0.75 million liters/day (0.197 mgd). Unlike Athens, however, the Corsicana potable water system currently operates with an excess flow of 13.2 million liters/day (3.5 mgd), more than enough to accommodate construction-phase in-migrants. The incremental water demand associated with projected in-migration to Malakoff is estimated at 0.58 million liters/day (0.154 mgd), which will consume most but not all of that city's .67 million liters/day (.177 mgd) excess capacity. Note that the Malakoff water system currently operates under an elevated storage deficit; any system expansion will further amplify the need to construct additional storage. The City of Trinidad is projected to incur a construction-related incremental water demand of 0.33 million liters/day (0.087 mgd), which will consume a small part of the city's 1.2 million liters/day (.324 mgd) excess capacity. Additional water demand will also require Trinidad to expand its elevated storage capacity. The City of Palestine's potable water system can supply about 17.0 million liters/day (4.5 mgd) in excess of current maximum daily use, more than enough excess treatment capacity to accommodate the projected 0.3 million liter/day (0.08 mgd) incremental demand associated with the project construction phase. As noted in Sec. 5.18.1, however, Palestine's system has an existing elevated storage deficit, and any additional user population will enhance the need for additional storage.

Expansion capacities of wastewater systems also vary among project-area municipalities. Again, the greatest impacts will be felt in the City of Athens, where the largest construction-related wastewater service demand (estimated at 0.81 million liters/day (0.214 mgd)) will occur. Athens appears to have no available excess treatment capacity under existing conditions. Corsicana, unlike Athens, has a wastewater system capable of handling about 9.0 million liters/day (2.4 mgd) in excess of current demands. This is sufficient to accommodate the projected 0.81 million liters/day (0.214 mgd) associated with project construction.

Incremental construction-related sewage system demand in Malakoff is estimated at 0.63 million liters/day (0.166 mgd), which exceeds existing excess capacity of .492 million liters/day (0.13 mgd). Existing excess capacity in Trinidad, estimated at .719 million liters/day (0.19 mgd), is sufficient to handle the construction-related system demand of 0.36 million liters/day (0.095 mgd). The lowest incremental demand is expected to occur in Palestine, where construction-related in-migrants will require an additional 0.33 million liters/day (0.087 mgd). The assessment of Palestine's existing wastewater treatment system (see Sec. 5.18.1) indicates little or no capacity for expansion under current conditions; the small construction-phase increment will therefore add to the need for system expansion.

Project-related in-migration will reduce the ratio of police and fire protection personnel to population in the local communities. The current ratio of law enforcement officers to population is slightly below recommended levels when viewing the project area as a whole. New residents to Corsicana, Athens and Malakoff will require two additional officers in each city, while Trinidad and Palestine will each require one officer to maintain current population to service ratios. A population influx of 4,720 persons represents a need for four additional firefighters in the project area. Athens, Corsicana, Malakoff and Trinidad may each receive sufficient new residents to warrant one additional firefighter.

The service ratio of doctors to population in the project area just meets nationally recommended levels, thereby warranting additional personnel with in-migrant population demand. The influx of 4,720 persons represents a need for two to three additional doctors, according to HEW service recommendations. With the greater proportion of in-migrants likely to move into Athens, Corsicana and Malakoff, an additional doctor would be needed in each of these cities. However, no significant, adverse impact is expected at existing service levels over the temporary construction period.

Assuming peak construction activities, the proposed project will contribute 402 in-migrating school-age children. Based upon a moderate level of existing excess capacity and anticipated "without project" minimal growth in enrollment, local school districts should be able to absorb the increased population. Potential in-migration, however, will increase teacher-student ratios. In order to maintain current teacher-student ratios, an additional 10 to 12 teachers would be needed in the three-county area, three each in the Athens, Corsicana and Malakoff school districts, two in the Trinidad school district and one in the Palestine school district. Planned facility expansions in both the Corsicana and Palestine school districts over the next three to five years will help to mitigate potential adverse impact. These include construction of an additional 30 classrooms in the Corsicana school district (Wardell, 1982) and a new middle school along with additional high school expansion in the Palestine school district (Thornton, 1982).

5.18.3.2 Impacts of Operation

The estimated in-migrant population of 2,952 during long-term project operations will require about 1.73 million liters/day (0.458 mgd) of potable water supply (5.3 million liters/day (1.4 mgd) during peak demand). Based on the assumed in-migrant population distribution among project area communities, Athens and Corsicana may be expected to receive approximately 797 operations-phase in-migrants each. As stated in Sec. 5.18.3.1, Athens' municipal water supply system is operating at or near capacity. If system improvements are made in response to the demands of the project construction phase, the relatively smaller operations-phase demand will not pose additional problems. Corsicana, with an excess flow potential of 13.2 million liters/day (3.5 mgd), will have no trouble meeting both construction- and operations-phase demands. The City of Malakoff, with excess flow capacity of .67 million liters/day (.177 mgd), could accommodate the demand for 0.363 million liters/day (.096 mgd) for the anticipated 620 operations-phase in-migrants, particularly if improvements to the city's treatment and storage facilaities are made in response to construction-phase demands. The Trinidad water system, with excess flow capacity of 1.2 million liters/day (.324 mgd), could easily accommodate the needs of operations-phase in-migrants for .208 million liters/day (.055 mgd). Similarly, the City of Palestine, with 17.0 million liters/day (4.5 mgd) excess treatment capacity, would not be affected by water demands of 0.19 million liters/day (0.05 mgd), provided that city's storage deficit is rectified.

Operations-phase wastewater service needs will also have varying effects on project area systems. Athens, with no currently available excess treatment capacity, will have to complete proposed system improvements to accommodate construction-phase impacts and the ensuing operations-phase demands of .508 million liters/day (.134 mgd). Corsicana's wastewater system, which is expected to receive a similar level of operations-phase demand, has excess treatment capacity estimated at about 9.0 million liters/day (2.4 mgd) and should experience no significant impacts. Incremental operations-related sewage system demand at Malakoff is estimated at 0.395 million liters/day (0.104 mgd), which would consume much of that city's excess capacity of .492 million liters/day (0.130 mgd). Existing excess capacity at Trinidad, estimated at .719 million liters/day (0.19 mgd), is amply sufficient to handle the operations-phase demand of .226 million liters/day (.059 mgd). The City of Palestine, which currently has little or no excess system capacity, is undertaking wastewater system improvements which should be sufficient to respond to construction-phase demands as well as the ensuing operations-phase demands of 0.207 million liters/day (0.055 mgd).

Project in-migration will not adversely affect local police and fire protection, particularly if minor additional staffing takes place to serve the increased construction population. However, if no personnel changes occur with the larger construction-period in-migration, it may be necessary to add a few police officers once the more permanent operations in-migration occurs. According to state and nationally recommended levels, a population influx of 2,952 represents a need for five to six officers. This additional staffing will likely be in Athens, Corsicana and Malakoff.

The operations-period population influx represents a need for one or two additional doctors. However, no significant adverse impact is expected to occur at the existing service level in the area, particularly if one or two doctors are added during the construction period.

The permanent operations work force will contribute 290 school-age children. In order to maintain existing teacher-student ratios, an additional two teachers would be needed in each of the Athens, Corsicana and Malakoff school districts. One additional teacher would be required in the Trinidad school district. Planned facility expansions will be completed by the time this increased enrollment occurs; therefore, no adverse impact is anticipated. As classroom capacity is increased, the school districts also plan to increase personnel levels, further mitigating adverse impact. Furthermore, any additional staffing during the construction period will alleviate personnel deficiencies during the operations period.

5.18.3.3 Impacts of Combined Operation and Construction

As discussed in Sec. 5.15.3.3, a five-year overlap period (1985-1990) exists during which a combined work force will be required. A combined peak population of 5,159 in-migrants is projected in 1987. Based on review of the projected population distribution, it is apparent that during the period from mid-1986 through mid-1987, slight (9 percent) in-migrant population increases will occur above those previously evaluated for the construction-related population peak. Therefore, the following disucssion is presented to evaluate the peak project-related impacts on community services and facilities.

The estimated peak in-migrating population of 5,159 will require approximately 3.03 million liters/day (0.801 mgd) of potable water supply, assuming an average consumption of 587 liters/capita/day (155 gallons per capita per day (gpcd)) (Chalmers and Anderson, 1977). Peak water consumption associated with this level of in-migration is estimated at 9.0 million liters/day (2.4 mgd), assuming peak demand as generally three times average use (Urban Systems Research and Engineering, 1980). Based on the assumed in-migrant population distribution among major communities shown in Table 5-41, the 1,393 newcomers to the City of Athens will require 0.82 million liters/day (0.216 mgd). As detailed in Sec. 5.18.1, Athens' municipal water system is already experiencing difficulty in meeting current demands, and additional in-migration will further stress system capacity. Recent local bond issues to upgrade the city's water system have not been successful. The 1,393 project-related in-migrants projected for the City of Corsicana are also expected to generate an incremental demand for about 0.82 million liters/day (0.216 mgd). Unlike Athens, however, the Corsicana potable water system currently operates with an excess flow of 13.2 million liters/day (3.5 mgd), more than enough to accommodate peak project in-migrants. The incremental water demand associated with projected peak in-migration to Malakoff is estimated at 0.64 million liters/day (0.168 mgd), which will consume most but not all of that city's .67 million liters/day (.177 mgd) excess capacity. Note that the Malakoff water system currently operates under an elevated storage deficit; any system expansion will further amplify the need to construct additional storage. The City of Trinidad is projected to incur a peak project-related incremental water demand of 0.36 million liters/day (0.096 mgd), which will consume a small part of the city's 1.2 million liters/day (.324 mgd) excess capacity. Additional water demand will also require Trinidad to expand its elevated storage capacity. The City of Palestine's potable water system can supply about 17.0 million liters/day (4.5 mgd) in excess of current maximum daily use, more than enough excess treatment capacity to accommodate the projected 0.34 million liter/day (0.09 mgd) incremental demand associated with the peak project-related in-migrant population. As noted in Sec. 5.18.1, however, Palestine's system has an existing elevated storage deficit, and any additional user population will enhance the need for additional storage.

Expansion capacities of wastewater systems also vary among project-area municipalities. Again, the greatest impacts will be felt in the City of Athens, where the largest project-related wastewater service demand (estimated at 0.89 million liters/day (0.234 mgd)) will occur. Athens appears to have no available excess treatment capacity under existing conditions. Corsicana, unlike Athens, has a wastewater system capable of handling about 9.0 million liters/day (2.4 mgd) in excess of current demands. This is sufficient to accommodate the projected 0.89 million liters/day (0.234 mgd) associated with the peak project in-migrant population.

Incremental project-related sewage system demand in Malakoff is estimated at 0.69 million liters/day (0.182 mgd), which exceeds existing excess capacity of .492 million liters/day (0.13 mgd). Existing excess capacity in Trinidad, estimated at .719 million liters/day (0.19 mgd), is sufficient to handle the peak project-related system demand of 0.39 million liters/day (0.104 mgd). The lowest incremental demand is expected to occur in Palestine, where project-related in-migrants will require an additional 0.36 million liters/day (0.095 mgd). The assessment of Palestine's existing wastewater treatment system (see Sec. 5.18.1) indicates little or no capacity for expansion under current conditions; the small construction-phase increment will therefore add to the need for system expansion.

Peak project-related in-migration will reduce the ratio of police and fire protection personnel to population in the local communities. The current ratio of law enforcement officers to population is below recommended levels when viewing the project area as a whole. New residents to Corsicana, Athens and Malakoff will require two additional officers in each city, while Trinidad and Palestine will each require one officer to maintain current population to service ratios. A population influx of 5,159 persons represents a need for six additional firefighters in the project area. Athens, Corsicana, Malakoff and Trinidad may each receive sufficient new residents to warrant one or two additional firefighters.

The service ratio of doctors to population in the project area just meets nationally recommended levels, thereby warranting additional personnel with in-migrant population demand. The influx of 5,159 persons represents a need for three to four additional doctors, according to HEW service recommendations. With the greater proportion of in-migrants likely to move into Athens, Corsicana and Malakoff, an additional doctor would be needed in each of these cities. However, no significant, adverse impact is expected at existing service levels over the temporary peak population period.

Assuming peak construction and operation activities, the proposed project will contribute approximately 440 in-migrating school-age children. Based upon a moderate level of existing excess capacity and anticipated "without project" minimal growth in enrollment, local school districts should be able to absorb the increased population. Potential in-migration, however, will increase teacher-student ratios. In order to maintain current teacher-student ratios, an additional 11 to 13 teachers would be needed in the three-county area, three each in the Athens, Corsicana and Malakoff school districts, two in the Trinidad school district and one in the Palestine school district. Planned facility expansions in both the Corsicana and Palestine school districts over the next three to five years will help to mitigate potential adverse impact. These include construction of an additional 30 classrooms in the Corsicana school district (Wardell, 1982) and a new middle school along with additional high school expansion in the Palestine school district (Thornton, 1982).

5.18.3.4 Cumulative

A second energy project in the three-county area represents a need for an additional 3 to 4 million liters/day (0.8 to 1.0 mgd) of both potable water supply and sewage system demand. The Malakoff EGS/Trinity Mine and the Forest Grove project represent a combined demand for approximately 4,200 to 4,800 new utility connections. None of the local communities could individually handle this demand for water connections, although Athens and Corsicana have excess sewage system capacity to each accommodate slightly more than 5,000 additional sewer connections (Tables 5-36 and 5-37). Based upon 1980-81 data, local utility systems combined can currently support an additional 6,286 water connections and 12,374 sewer connections. In order to minimize significant, adverse impact, in-migration would need to be distributed among several of the major communities.

It should be noted, however, that this demand represents the estimated peak employment demand, and therefore, it will build up over five to six years and then taper off to a smaller, long-term demand over project life.

The cumulative peak population influx of 9,700 to 11,500 persons represents a need for approximately 18 additional police officers, 14 firefighters and 7 doctors under recommended state and national operating levels. With regard to the potential cumulative impact on local schools, it is anticipated that additional staffing will not likely occur until the more permanent operation in-migration becomes evident. The influx of an estimated 500 to 600 school-age children during project operations represents a need for approximately 16 to 20 additional teachers to maintain the current average teacher-student ratio of 1:31, which already exceeds the nationally recommended range of 1:20 to 1:27.

5.19 LOCAL GOVERNMENT FINANCES

5.19.1 Existing Environment

Ad valorem and sales taxes account for the majority of all county and municipal revenues in the project area. The principal local government expenditures include street and road maintenance, public safety and general administration.

All of the project area cities with the exception of Athens, reported both general obligation debt (tax-supported debt) and special obligation debt (revenue bonds) in 1981. All of the local revenue bonds have been issued for waterworks and sewer system expansion and/or improvements. Debt obligation represents a small percentage of assessed valuation in all of the major communities, making additional bonding capacity available for capital improvements. In addition, debt coverage in all but Corsicana was above the recommended 1.5 times the debt requirement thereby enabling cities to service current debt.

5.19.2 Impacts of No Action Alternative

Water and sewer system facilities will continue to be the major items requiring issuance of revenue bonds. Based upon actual future populations, cities are expected to incur additional debt for water and sewer expansions/improvements. The proposed reduction from 75 percent to 55 percent of the Federal share of the allowable cost for construction of a wastewater treatment plant will result in an increased burden on local financial resources in cities requiring system improvements.

5.19.3 Impacts of Project Alternatives

5.19.3.1 Impacts of Construction

Due to the speculative nature of any potential changes in property values as a result of the proposed project, the impacts on government finances can only be addressed in general terms. It can reasonably be assumed that with significant population increases during the peak construction period, local governmental expenditures will generally increase to provide additional community services. However, the additional revenues from project-related activities (i.e., property taxes) and general economic development lag behind the increased expenditures that are induced by the project population influx. Accordingly, there can be a short-term imbalance between local revenues and expenditures until the expanding population drops during the project operation period.

During construction, the most evident source of revenue will be sales taxes from the increased sales volume associated with in-migration. Based upon a one percent local sales tax and the assumption that approximately 55 percent of individual family budgets is spent on retail, revenues stemming from increased consumer spending are estimated at $1.1 million during peak employment in 1986.

Property taxes levied on Malakoff EGS/Trinity Mine land and facilities will not be realized until into the project operation period. However, depending upon the level of residential property purchased during project construction, some property tax revenue could be generated. Based upon construction worker survey data compiled for similar energy projects (Denver Research Institute, 1979; Mountain West Research, Inc., 1975), the majority of the construction work force will rent housing or set up a mobile home for the temporary construction period.

With regard to specific government expenditures in the project area likely to result from project-related activities, police and fire protection, schools and health facilities appear to require some level of expansion. Hospital and school facilities are currently being planned, and project in-migration will further demonstrate the need for these improvements. Expenditures for police and fire protection services are likely to be in the area of increased staffing. The level of expenditure required for water and wastewater system improvements will vary among project area communitites. In Athens, current user demands on water and wastewater systems equal or exceed current design capacity. The City is seeking Federal grant assistance for wastewater system improvements. In Corsicana, both water and wastewater systems appear to have ample excess capacity to handle more than the predicted in-migrating population during construction. The potable water system of the City of Malakoff has sufficient excess treatment capacity to accommodate anticipated in-migrating population, but will require storage capacity in excess of its current capacity. The Malakoff wastewater system is now operating at or near design capacity and will require expansion to accommodate growth. Trinidad has sufficient excess treatment capacity for both water and wastewater systems, but will have to expand potable water storage capacity. Palestine will also need to add potable water storage capacity; the City has received approval for a wastewater construction grant to make system improvements required by current user demand.

5.19.3.2 Impacts of Operation

During project operation, local revenue will be generated through property taxes levied on project land and facilities and new residential properties; sales taxes stemming from increased sales volume due to in-migration; and lignite leases.

The improvements on the land of the project site are anticipated to yield substantial tax increases over those paid on this same land over previous years under agricultural use.

The project site is located within Henderson and Anderson counties and at the border of the Malakoff and Cross Roads Independent School Districts (ISD). Accordingly, each jurisdiction will levy taxes in proportion to the extent project property is located within its respective jurisdiction.

Based upon current tax rates of the project area taxing authorities and an estimated demand of approximately 600 single family dwellings, the local area could receive an average of $0.4 to 0.7 million in residential property taxes annually. Sales tax revenues associated with increased consumer spending are estimated at approximately $0.2 million annually.

5.19.3.3 Cumulative

Due to the speculative nature of financial considerations, it is difficult to estimate cumulative impacts beyond the discussion regarding the proposed project.

5.20 TRANSPORTATION

5.20.1 Existing Environment

Highways are the major transportation facilities in the project area. Existing traffic volumes along major access routes between local communities and the proposed project site are contained in Table 5-44. Most of the roads in the area average 500 to 2,500 vehicles per day with the exception of State Highway 31 which averages 5,000 to 10,000 vehicles. According to the last traffic composition survey conducted in the project area (March, 1978), traffic along State Highway 31 between Corsicana and Athens is comprised of 60 percent passenger cars and 40 percent trucks.

Passenger bus, motor and rail freight, and limited air service are also available in the region.

5.20.2 Impacts of No Action Alternative

At the present time, no new major transportation facilities are planned in the immediate project area in the foreseeable future. Traffic volumes are expected to fluctuate depending upon the extent and location of development in the area. With increased

TABLE 5-44
EXISTING TRAFFIC VOLUMES OF MAJOR ACCESS ROUTES BETWEEN LOCAL COMMUNITIES AND PROJECT SITE

Access Route	Location	Average Vehicles Per Day
SH 31	a) between Malakoff and Kerens	5,400 - 7,000
	b) between Malakoff and Athens	7,000 - 10,000
FM 90	a) north of Malakoff	4,000
	b) between Malakoff and Cross Roads	600 - 1,100
SH 59	between Cross Roads and Cayuga	800 - 1,000
SH 19	between Palestine and Athens	1,500 - 2,300
U.S. 287	between Palestine and Cayuga	1,400 - 1,900

Source: Texas Department of Highways and Public Transportation, 1980.

energy development throughout the East Texas region, commuter and truck traffic is likely to increase.

5.20.3 Impacts of Project Alternatives

5.20.3.1 Impacts of Construction

Construction of the Malakoff EGS/Trinity Mine will increase traffic along major access roads between the project site and local communities. State Highway 31 and Farm-to-Market Road 90 are the most immediate access routes to the site, and are likely to experience traffic increases as a result of both equipment movement and employee trips. In addition, U.S. 287 and State Highways 19 and 59 are expected to carry greater traffic volumes.

The 2,436 workers living within 48 km (30 mi) of the project site (existing residents plus in-migrants) are projected to generate approximately 3,748 vehicle trips per day during peak construction in 1986 (assuming 1.3 persons per vehicle making two trips per day). Furthermore, there will be another 812 workers who will commute from beyond 48 km (30 mi) from the project site, generating an additional 1,249 vehicle trips per day. Based upon the estimated in-migrant population distribution (Sec. 5.15.3) and potential origins of commuting workers (i.e., Tyler, southeast Dallas), State Highway 31 will carry the majority of the project-related employee trips, averaging an increase of approximately 50 to 80 percent (4,500 trips) over existing traffic volumes. Farm-to-Market Road 90 and State Highway 59, providing access to areas south of the project site (i.e., Cross Roads, Cayuga, Palestine), are likely to experience traffic volume increases of 40 to 60 percent (400 trips), while traffic along U.S. 287 out of Palestine could increase by 20 to 30 percent (400 trips). Peak construction traffic, however, will only occur during a six- to nine-month period in 1986.

In addition to project employee traffic, there will be additional traffic generated by delivery and service vehicles coming to the site. On the average, an estimated 30 to 60 one-way commercial truck deliveries will occur per day during construction activities. Also, there will be increased traffic between communities due to additional service workers and families travelling back and forth. These kinds of variables, however, are difficult to quantify with adequate reliability.

In general, the serviceability of farm-to-market roads may be affected due to increased traffic, particularly trucks. These roads are not constructed for large volumes or particularly heavy loads. Therefore, an increase in heavy wheel loads will affect the flow of traffic along these routes, as well as contribute to road surface deterioration more quickly than would otherwise occur.

Apart from increasing traffic volumes, project construction will require a number of road improvements and/or relocations. Some of the limited use county roads at the project site will be relocated through void or reclaimed areas in advance of surface mining operations. Relocations of sections of State Highway 90, U.S. 287 and several farm-to-market roads will take place after 1990 during project operation. HL&P will upgrade the county road from Farm-to-Market Road 90 to the Antioch Cemetery, and install acceleration and deceleration lanes on State Highway 31 at its intersection with the plant access road. Approval of the local county highway commissioner will be obtained prior to any road closures and/or relocations. In all cases, the new road structure will be built to meet or exceed construction standards of the original road surface.

Due to their proximity to the proposed mining area, the communities of Cross Roads and Cayuga are likely to be affected by increased truck traffic and equipment movement nearby.

5.20.3.2 Impacts of Operation

The 1,107 workers anticipated to travel between the project site and local communities over the project life will generate approximately 1,703 vehicle trips per day. The increased traffic volume during operation will not adversely affect local traffic flow once the larger construction traffic level diminishes. State Highway 31 will likely carry most of the operations period traffic amounting to a five to ten percent increase over existing flow along this route.

Relocation of sections of U.S. 287, Farm-to-Market Road 90 and several county roads during project operation will interrupt traffic movement temporarily.

5.20.3.3 Cumulative

The estimated 3,400 jobs associated with Forest Grove represent 5,200 vehicle trips per day in the project site vicinity in addition to the 5,450 during Malakoff EGS/Trinity Mine construction and operation. Because of the proximity of the two project sites, many of the same highways are expected to carry the increased traffic volume.

5.21 RECREATIONAL FACILITIES AND AESTHETICS

5.21.1 Existing Environment

Major recreation areas in Henderson County include Lake Palestine, Lake Athens and the 15,890-ha (38,750-ac) Cedar Creek Reservoir. Located in the northwestern portion of the county and operated for recreational purposes, in addition to providing Fort Worth's municipal water supply, Cedar Creek Reservoir is the major recreation site for several counties. Smaller Navarro Mills Lake, Lake Halbert and Lake Corsicana are located in Navarro County.

5.21.2 Impacts of No Action Alternative

No major recreation projects are planned for the project area in the foreseeable future, although facility expansions and/or improvements at individual recreation sites are expected to occur as the need arises. If the proposed project is not constructed, the recreation and aesthetic resources of the area will remain unchanged during the short term. Potential long-term effects will follow existing land use trends as discussed in Sec. 5.22.

5.21.3 Impacts of Project Alternatives

5.21.3.1 Impacts of Construction

Conversion of the Malakoff EGS site to long-term industrial use and anticipated conversion of forested areas into improved pasture will result in loss of any hunting on this acreage. None of the area lakes and/or parks will be directly affected by project construction, although recreational users may experience additional traffic on area roads and highways, particularly truck traffic.

The introduction of surface mining, an electrical generating station and associated pipelines and transmissions lines will have an effect on the aesthetics of the area. The greatest visibility of the proposed transmission line will be to motorists traveling east and west along State Highway 31. Mine operations will be most visible to motorists when mining activities occur near Farm-to-Market Road 90.

The influx of up to 5,159 new residents into the project area will result in increased user demands on area recreational facilities. Greatest effects will probably occur in and near the City of Malakoff, which has only one municipal park. Some effect may occur in Trinidad, with one municipal park, and Athens, with five municipal parks. The abundance of public and private recreational resources in the region generally, however, should be able to absorb recreational user needs associated with population in-migration. In addition to the municipal parks in Athens, Trinidad and Malakoff, for example, Henderson County offers four other municipal parks, several public boat ramps, one municipal golf course, six rural parks and more than 20 commercial recreational facilities. Corsicana and Palestine and environs, where project-related user demands will be relatively less, also offer a variety of municipal, rural and commercial recreational resources.

5.21.3.2 Impacts of Operation

None of the area recreational resources will be directly affected by project operation. Potential impacts are similar to those during project construction.

5.21.3.3 Cumulative

No significant cumulative impact is expected to occur.

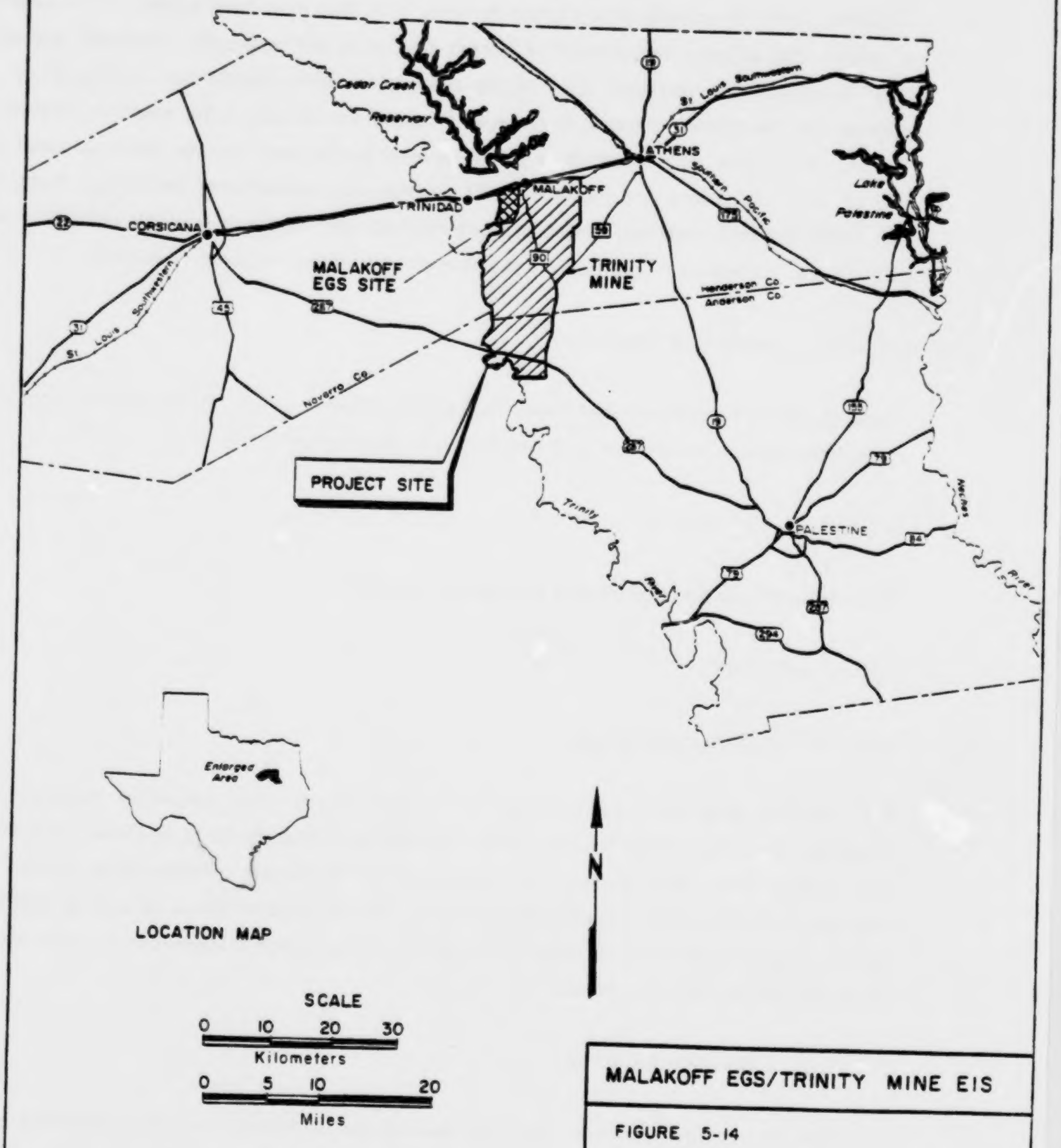
5.22 LAND USE

5.22.1 Existing Environment

The existing land uses are surveyed for a two-county area including Henderson and Anderson counties and for the 23,616-ha (57,600-ac) Malakoff Electric Generating Station and Trinity Mine sites located in Henderson and Anderson counties (Fig. 5-14). This comparative analysis facilitates evaluation of the site area in terms of overall suitability for the proposed activity by highlighting similarities and/or differences in local land use vis-a-vis the two-county trends.

5.22.1.1 Regional Land Use

The two-county project area land use description is based upon data provided by the U.S. Department of Agriculture, Soil Conservation Service (SCS); the Texas Forest


Cedar Creek Reservoir
19
St Louis Southwestern
31
ATHENS
Southern Pacific
Lake Palestine
MALAKOFF
TRINIDAD
22
CORSICANA
175
59
90
MALAKOFF EGS SITE
TRINITY MINE
Henderson Co
Anderson Co
45
287
31
St Louis Southwestern
Navarro Co
19
155
PROJECT SITE
287
79
Neches River
Trinity River
PALESTINE
84
79
287
294
Enlarged Area
LOCATION MAP
N
SCALE
0 10 20 30
Kilometers
0 5 10 20
Miles

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5-14

GENERAL LOCATION MAP

Service; the University of Texas, Bureau of Economic Geology; and the East Texas Council of Governments (ETCOG).

Existing Land Use. Existing land use data for the two-county region are presented in Table 5-45. These data were developed in a study directed by the U.S. Department of Agriculture, Soil Conservation Service (U.S. Department of Agriculture, 1980). Definitions for the various uses are included in the Glossary.

Major land uses are: pastureland (45.7 percent), forest land (43.4 percent), cropland (2.9 percent), urban land (4.2 percent) and water areas (3.5 percent).

Agricultural Land. Crop production in Anderson County and Henderson County comprise 84.5 percent and 15.5 percent, respectively, of the two-county region's cropland.

Table 5-46 indicates the crop yields for the two-county region between 1978 and 1980. As shown, the principal crops in the two-county region are upland cotton, wheat, oats, rye, grain sorghum, grain corn, peanuts and hay. Of the approximately 28,835 ha (70,330 ac) of total cropland harvested in the two-county region in 1978, approximately 22,017 ha (53,700 ac) or 72 percent were comprised of hay production. In 1980, 25,789 ha (62,900 ac) were harvested, a decline of 10.6 percent or 3,046 ha (7,430 ac) of which about 20,992 ha (51,200 ac) or nearly 81 percent of total acres harvested consisted of hay products. Reductions in grain production were significant, over this three-year period, particularly in grain sorghum and corn. The trends indicate agricultural production has shifted from cash crops to production for livestock support. Information on cash receipts from agriculture also indicate the major agricultural source of income is from livestock production. Livestock production accounts for over 85 percent of total regional cash receipts in 1980, 86.7 percent in Anderson County and 85.1 percent in Henderson County.

Long-term census data also indicate a decline in overall agricultural production in the region. According to the U. S. Census of Agriculture for 1969 and 1978, both the total number of farms and total land in farms declined substantially in the two-county region.

Pastureland. Pastureland in the two-county region constitutes the principal agricultural land use with approximately 242,170 ha (590,659 ac), consisting largely of coastal bermudagrass and other adapted species.

TABLE 5-45

LAND USE DISTRIBUTIONS IN THE TWO-COUNTY STUDY AREA, 1978

(in acres)[a]

	Land Use Classification						
County/Item	Cropland	Pasture Land	Urban/ Built-up Land	Forest Land	Water Area	Other[b]	Total
Anderson							
Acres in Land Use	31,387	279,783	25,714	344,724	1,720	4,032	687,360
Percent of County Acreage	4.6	40.7	3.7	50.2	0.2	0.6	100.0
Percent of Total Regional Acreage	2.4	21.7	2.0	26.7	0.1	0.3	53.2
Percent of Land Use Category in Region	84.5	47.4	47.1	61.5	3.8	98.8	d
Henderson							
Acres in Land Use	5,752	310,876	28,922	216,193	43,010	47	604,800
Percent of County Acreage	1.0	51.4	4.8	35.7	7.0	0.1	100.0
Percent of Total Regional Acreage	0.4	24.1	2.2	16.7	3.3	c	46.8
Percent of Land Use Category in Region	15.5	52.6	52.9	38.5	96.2	1.2	d
Two-County Project Area							
Acres in Land Use	37,139	590,659	54,636	560,917	44,730	4,079	1,292,160
Percent of Total Regional Acreage	2.9	45.7	4.2	43.4	3.5	0.3	100.0
Percent of Land Use Category in Region	100.0	100.0	100.0	100.0	100.0	100.0	d

a. For metric unit equivalent, please refer to metric conversion table located in the Glossary.

b. Other includes built-up areas, non-urban including cemeteries, roadways, etc.

c. Less than 0.1 percent.

d. Not applicable.

Source: U. S. Department of Agriculture, 1980.

TABLE 5-46
AGRICULTURAL STATISTICS FOR TWO-COUNTY REGION

Production (unit)[a]	County by Year					
	Anderson			Henderson		
	1978	1979	1980	1978	1979	1980
Upland Cotton						
Production (net bales)[b]	360		350			
Harvested Acres	430		600			
Yield per Harvested Acre (lb)[c]	401.8		280.0			
Wheat						
Production (bu)[d]	15,000	24,700	16,000	16,000	35,900	22,000
Harvested Acres	800	1,000	500	800	1,000	700
Yield per Harvested Acre (bu)	18.8	24.7	32.0	20.0	35.9	31.4
Oats						
Production (bu)		4,000		10,000	23,400	16,500
Harvested Acres		100		400	600	500
Yield per Harvested Acre (bu)		40.0		25.0	39.0	33.0
Rye						
Production (bu)	5,800	2,000	2,100	6,500	6,200	27,900
Harvested Acres	300	100	100	400	300	1,300
Yield per Harvested Acre (bu)	19.3	20.0	21.0	16.3	20.7	21.5
Grain Sorghum						
Production (bu)	52,400	29,120	26,040	12,100	13,440	3,360
Harvested Acres	2,600	1,200	1,500	600	600	200
Yield per Harvested Acre (bu)	20.2	20.2	15.7	20.2	20.2	15.1
Grain Corn						
Production (bu)	112,500	76,000	21,000	33,200	86,800	24,000
Harvested Acres	2,900	1,900	800	1,000	2,000	500
Yield per Harvested Acre (bu)	38.8	40.0	26.3	33.2	43.4	48.0
Peanuts						
Production (lb)	2,632,000	5,240,000	1,683,000	1,029,000	1,248,000	261,000
Harvested Acres	4,400	4,000	3,300	800	900	700
Yield per Harvested Acre (lb)	598	1,310	510	1,286	1,387	875
Hay, excluding sorghum						
Production (ton)[e]	45,800	49,000	59,100	53,000	105,200	59,400
Harvested Acres	25,300	16,000	22,000	28,400	28,500	29,200
Yield per Harvested Acre (ton)	1.8	3.1	2.7	1.9	3.7	2.0
Cowpeas						
Production (lb)				1,200	701,700	429,300
Harvested Acres					600	1,000
Yield per Harvested Acre (lb)				33.3	1,169.5	429.3
Total Harvested Acres - All Crops	36,730	24,300	28,800	33,600	34,500	34,100
Total Cash Receipts (1,000 Dollars)						
All Crops	2,856	4,079	3,035	3,324	4,968	5,743
Livestock and Livestock Products	18,380	26,995	19,895	27,623	34,331	32,827
Total Crops and Livestock	21,236	31,074	22,930	30,947	39,299	38,570

a. For metric unit equivalent, please refer to metric conversion table located in the Glossary.

b. Net bale of cotton is 480 lb.

c. Pound.

d. Bushel.

e. Ton.

Source: U. S. Department of Agriculture, Texas Department of Agriculture, Texas County Statistics 1978, 1979, 1980.

Forest Land. Anderson County contains the largest acreage of forest land, with 141,337 ha (344,724 ac) or 50.2 percent of the county and 61.5 percent of the forest land in the two-county region. Henderson County, with 88,639 ha (216,193 ac) of forest land or 35.7 percent of the county, accounts for 38.5 percent of the region's forest land.

Other Uses. Urban land and built-up land comprises about 22,401 ha (54,636 ac) or 4.2 percent of the land in the two-county region. Urban uses in Anderson County total 10,543 ha (25,714 ac) and 11,858 ha (28,922 ac) in Henderson County.

Water areas total 18,339 ha (44,730 ac) in the region or 3.5 percent. Over 96 percent or 17,634 ha (43,010 ac) of the total water area is located in Henderson County. About 705 ha (1,720 ac) of water area are in Anderson County.

Oil and Gas Production. Numerous oil and gas wells are located throughout the regional study area. These wells are source of income for landowners, as well as a source of employment to many people. Henderson County is the largest gas producing county in the study area with 71,823 thousand m^3 (25,651,045 thousand ft^3) of gas well gas produced in 1980. Anderson County wells produced the greatest amount of crude oil at 3,839,890 barrels for the year 1980. Table 5-47 indicates oil and gas production figures by county during 1980.

Land Use Trends. During the latter part of the 1800s and early part of the 1900s, forest land, pastureland and native rangeland shifted to the production of row crops. The principal row crop produced during this period was cotton. Cotton production steadily declined in the region due to several factors. These factors include: 1) the increasing infestation of crop-damaging insects; 2) the steady degradation of the soils productive capacity from continuous cotton management practices and topsoil loss; 3) the steady price increase for livestock and livestock products; and 4) the availability of refrigerated rail cars which expanded the marketing area for food crops.

During the 1920s, farmers and ranchers along the Trinity River organized the Henderson County Levee Improvement District No. 3 for the purpose of constructing and maintaining flood control levees for the protection of agricultural lands. In 1927, a levee was constructed to protect the area from floodwaters of the Trinity River on the west and divert water north and south of the area from the eastern tributaries of Walnut, Turkey, Prairie and Wildcat creeks.

TABLE 5-47
OIL AND GAS PRODUCTION IN THE
TWO-COUNTY REGION

County	Gas Well Gas		Condensate		Crude Oil		Casinghead	
	1,000 m^3	(1,000 ft^3)	m^3	(bbl)	cm^3	(bbl)	1,000 m^3	(1,000 ft^3)
Anderson	174,975	(6,249,110)	11,435	(71,916)	610,543	(3,839,890)	247,592	(8,842,564)
Henderson	718,229	(25,651,045)	6,868	(43,192)	468,933	(2,949,278)	569,798	(20,349,921)

Source: Texas Railroad Commission, 1980.

Since the 1930s, the land has been used to support livestock production which has surpassed the cultivation of row crops as the major source of farm income. Grain sorghum has now surpassed cotton as the principal row crop. However, row crop production acreage has remained small in comparison to the average used for livestock production. Progressively more of the region's grain production bypasses the market and is used as a supplement to grazing. New grasses have been successfully introduced into the region, replacing traditional crops and native grasses.

Table 5-48 indicates recent trends in land use in the two-county region. The data for 1958 and 1967 represent an inventory of land uses developed by the Texas Conservation Needs Committee under the direction of the U.S. Soil Conservation Service. With minor variations in the amount of inventoried land and in land use definitions, for water areas, urban built-up and other areas, the report provided data comparable to the 1977 data included in Table 5-45.

As shown in Table 5-48, the land in crops (including hay meadows) has declined substantially between 1958 and 1978. In the two-county region, between 1958 and 1967, cropland declined by 62.1 percent or over 72,000 ha (175,500 ac). This trend continued in the 1967 to 1978 period with a reduction of 65.3 percent, an additional loss of about 28,700 ha (70,000 ac) of cropland.

Lands used for pasture increased substantially over the 20-year period. The majority of this land is coastal bermudagrass, with varying levels of improvement (i.e., management may range from introduction of species and fertilization to mowing practices).

Forest lands have also decreased in the two-county region. In Anderson County, forest land declined by about 20,572 ha (50,176 ac), an 12.8 percent decrease between 1958 and 1978. Forest land decreased by about 15.7 percent or about 16,444 ha (40,107 ac) between 1958 and 1978 in Henderson County. According to the SCS report (1970), 37 percent of the forest area in Anderson County was used for grazing in 1967, and in Henderson County, 100 percent was used for grazing. In 1968, forest lands used for grazing accounted for over 65 percent of total forest lands with most of the remaining forest land classified as non-commercial.

Another trend in land use that has become evident over the past several years is the increasing amount of sand and gravel mining in the alluvial areas of the Trinity River. On

TABLE 5-48
LAND USE TRENDS IN THE TWO-COUNTY REGION
(in acres)[a]

County/Year	Cropland	Pasture	Range	Urban/ Built-up	Forest Land	Water Area	Other	Total[b]
Anderson								
1958	95,800	160,300	300	18,700	394,900	3,900	8,800	660,100
1967	64,260	183,191	0	28,278	389,500	4,310	16,733	653,684
1978	31,387	279,783	0	25,714	344,724	1,720	4,032	687,360[b]
Percent Change 1958-1967	-32.9	52.7	-100	51.2	-1.4	10.5	90.1	-1.0
Percent Change 1967-1978	-51.2	14.3	0	-9.1	-11.5	-60.1	-255.2	5.2
Henderson								
1958	186,900	121,400	0	17,500	256,300	3,100	13,900	578,600
1967	42,888	310,219	0	20,463	193,800	33,340[c]	2,554[c]	579,461
1978	5,752	310,876	0	28,922	216,193	43,010[c]	47	604,800
Percent Change 1958-1967	-77.1	156.5	0	16.9	-24.4	975.5	-81.7	0.2
Percent Change 1967-1978	-86.6	0.2	0	41.3	11.6	29.0	-98.2	4.4
Two-County Region								
1958	282,700	281,700	300	36,200	651,200	7,000	22,700	1,238,700
1967	107,148	493,410	0	48,741	583,300	37,650	19,287	1,233,145
1978	37,139	590,659	0	54,636	560,917	44,730	4,079	1,292,160
Percent Change, 1958-1967	-62.1	75.2	100	34.6	-10.4	437.9	-15.0	-0.4
Percent Change, 1967-1978	-65.3	19.7	0	12.1	-3.8	18.8	-78.9	4.8

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a. For metric unit equivalent, please refer to metric conversion table located in the Glossary.

b. Total land inventories.

c. Cedar Creek Reservoir, approximately 30,000 ac surface area was included as other in 1967 and water area in 1977; shifted in 1967 to water area category for comparability.

a regional basis, large amounts of sand, gravel and clay are mined commercially in Henderson County, whereas little, if any, is mined in Anderson County. The sand and gravel are used primarily in construction, and clay is used in manufacturing brick and pottery products.

Land use trends in the two-county region indicate a dramatic reduction in cropland and an increase in lands used for cattle grazing. Additionally, urban development is occurring throughout the area.

5.22.1.2 Project Area Land Use

The total project area contains approximately 23,616 ha (57,600 ac) consisting of 1,394 ha (3,400 ac) for the power station and 22,222 ha (54,200 ac) for the mine. This area is bounded on the north by Highway 31 and the town of Malakoff, on the west by the Trinity River, on the east by the towns of Cross Roads and Cayuga, and extends south approximately 2.8 km (1.75 mi) south of and parallel to Highway 287.

The existing land use data are based upon color infrared stereo-photographs taken by Aero Services, Inc., in September, 1981. These photographs cover the entire project area. Professors White and Maggio of Texas A&M University interpreted project area land use/land cover based upon modified USGS land use/land cover definitions. EH&A planimetered land uses for the Malakoff EGS site using the modified USGS categories developed by NACCO and NACCO planimetered the Trinity Mine area. The distribution of land uses is indicated in Table 5-49. Figure 5-15 indicates the land use.

Malakoff Electric Generating Station. The predominant land use within the Malakoff EGS site boundary is agricultural, consisting of approximately 656 ha (1,601 ac) of improved pasture and about 200 ha (489 ac) of unimproved pasturage. Forest land, consisting of deciduous, evergreen and mixed stocks, accounts for approximately 511 ha (1,247 ac) or 36.7 percent of the 1,394-ha (3,400-ac) site. The commercial-only use of forest land consists of forage for livestock.

Of the total 1,394 ha (3,400 ac) power station site, about 437 ha (1,066 ac) will be disturbed consisting largely of improved and unimproved pasture land and some upland forest (see Sec. 5.22.3 for additional information).

TABLE 5-49
EXISTING LAND USE IN THE MALAKOFF EGS/TRINITY MINE AREA IN ACRES

		Power Plant		Mine		Total Project Area	
Map Code	Land Use Type	Acres[a]	Percent of Power Plant Area	Acres[a]	Percent of Mine Area	Acres	Percent of Project Area
1	Urban or Built-up	22.9	0.7	249.9	.5	272.8	0.5
2	Agricultural	2,089.8	61.5	36,320.6	67.0	38,410.4	66.7
21,24	Cropland, Orchards	0	0	741.0	1.3	741.0	1.3
22	Improved Pasture[b]	1,601.2	47.1	28,779.1	53.1	30,380.3	52.7
23	Unimproved Pasture	488.6	14.4	6,800.5	12.6	7,289.1	12.7
4	Forest Land[b]	1,247.2	36.7	17,063.1	31.5	18,310.3	31.8
5	Water[b]	40.1	1.2	204.4	0.3	244.5	0.4
7	Barren Lands[b]	0	0	362.0	0.7	362.0	0.1
	TOTAL, ALL USES	3,400	100.0	54,200	100.0	57,600	99.5[c]

a. For metric unit equivalent, please refer to metric conversion table located in the Glossary.

b. Additional detail shown on Land Use Map, Fig. 5-15.

c. Does not equal 100 percent due to rounding error.

Source: Trinity Mine, map and acreage distribution of NACCO 1982; Malakoff EGS Power Plant mapping, NACCO 1982, Acreage Distribution, EH&A, 1982.

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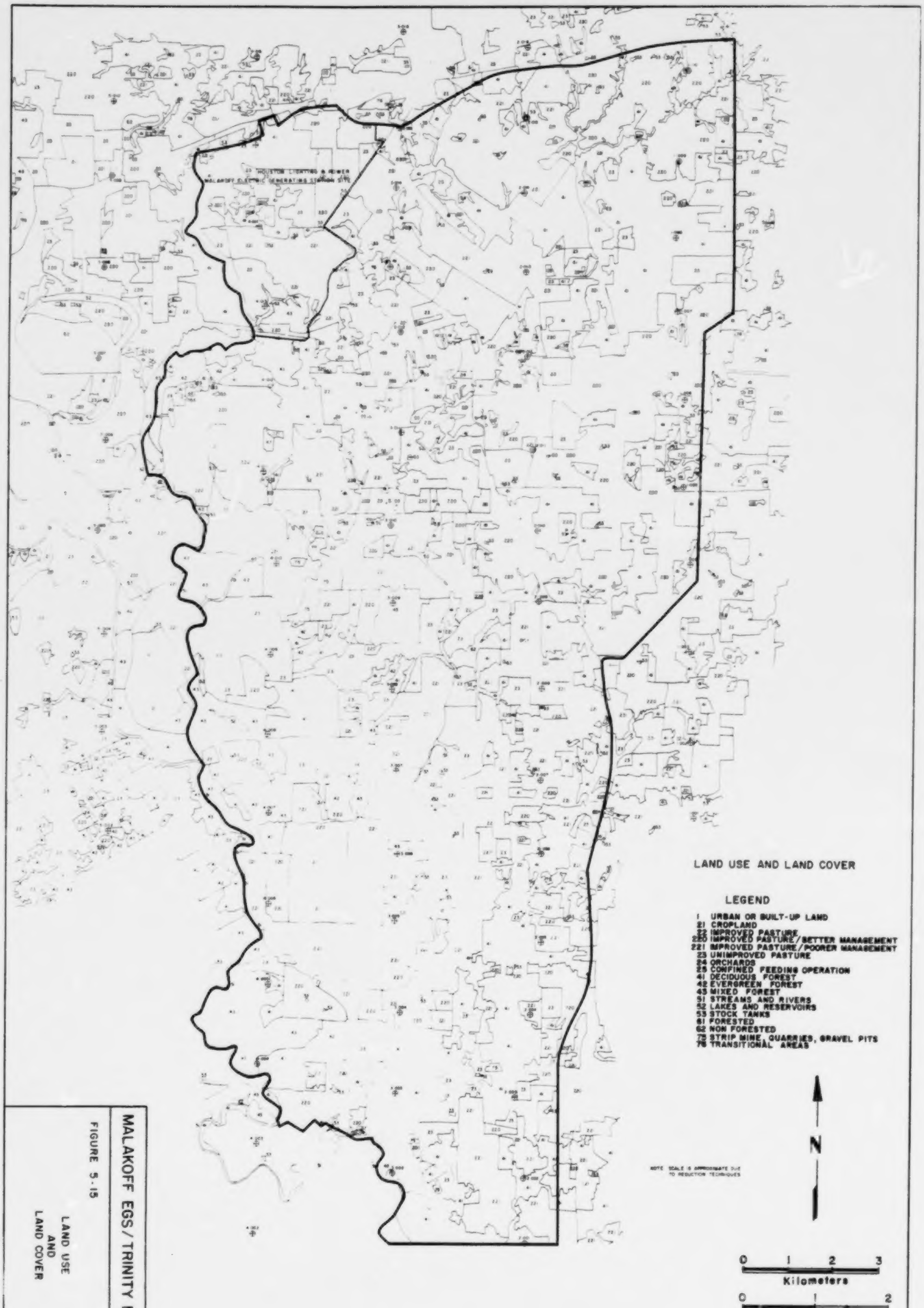

HOUSTON LIGHTING & POWER
MALAKOFF ELECTRIC GENERATING STATION SITE
LAND USE AND LAND COVER
LEGEND
1 URBAN OR BUILT-UP LAND
21 CROPLAND
22 IMPROVED PASTURE
220 IMPROVED PASTURE/BETTER MANAGEMENT
221 IMPROVED PASTURE/POORER MANAGEMENT
23 UNIMPROVED PASTURE
24 ORCHARDS
25 CONFINED FEEDING OPERATION
41 DECIDUOUS FOREST
42 EVERGREEN FOREST
43 MIXED FOREST
51 STREAMS AND RIVERS
52 LAKES AND RESERVOIRS
53 STOCK TANKS
61 FORESTED
62 NON FORESTED
75 STRIP MINE, QUARRIES, GRAVEL PITS
76 TRANSITIONAL AREAS
N
NOTE: SCALE IS APPROXIMATE DUE TO REDUCTION TECHNIQUES
0
1
2
3
Kilometers
0
1
2
Miles

SOURCE: NACCO

MALAKOFF EGS/TRINITY MINE EIS

FIGURE 5.15

LAND USE
AND
LAND COVER

Transmission Line Corridors. The Malakoff to Trinidad-Forest Grove transmission lines right-of-way was surveyed for land uses and mapped (see Table 5-50). The proposed transmission lines length are about 3.7 km (2.3 mi). Approximately 1.3 km (0.8 mi) of the transmission lines will be within the Malakoff EGS project boundary. The remaining 2.4 km (1.5 mi) will occupy 91.4-m (300-ft) wide corridor outside the site boundary.

The proposed right-of-way totals 33.38 ha (81.43 ac), including 10.91 ha (26.59 ac) located within the Malakoff EGS project boundary. Major land uses consist of pastureland (50.53 percent) and undeveloped land including forested areas (34.89 percent). No croplands are included in the proposed right-of-way.

Coal Conveyor. The coal conveyor will span from the Malakoff EGS site to the mine silo. The conveyor corridor is approximately 2.74 km (9,000 ft) long and 12.2 m (40 ft) wide for a total acreage of about 3.4 ha (8.3 ac). The conveyor (and parallel service road) will occupy pastureland and undeveloped forested areas.

Makeup Water Pipeline. The 72.6-km (45-mi) makeup water pipeline will affect approximately 336 ha (820.48 ac) of land during the short-term construction period. Land uses include undeveloped land (35.3 percent), grazingland (33.05 percent) and pastureland (16.84 percent). The pipeline will cross 10 roadways, including U.S. Highway 79, and 2 railroads. Water will be diverted from the Neches River, in a river segment listed in the Nationwide Rivers Inventory. The intake structure will be located immediately upstream of an existing channel dam.

Mine. Agricultural uses account for about 14,891 ha (36,321 ac), or 67.0 percent of the total mine area. Cropland represents about 298 ha (727 ac); improved pasture, 11,799 ha (28,779.1 ac); unimproved pasture, 2,788 ha (6,800.5 ac); and orchards, 6 ha (13.8 ac).

Forest land accounts for 6,996 ha (17,063.1 ac), or about 31.5 percent of the project area. Deciduous forests account for about 85.2 percent and mixed (deciduous/evergreen) forests account for about 9.6 percent of forest lands.

Water areas include about 84 ha (204.4 ac) with 90 percent accounted for stock tanks. Within the project boundaries, there are 102 ha (249.9 ac) in urban or built-up land uses and 148 ha (362.0 ac) of barren lands. Included as barren lands are 122 ha (296.5 ac) of sand and gravel pits.

TABLE 5-50

AREAL EXTENT OF LAND USE CATEGORIES WITHIN THE 300 FT RIGHT-OF-WAY OF THE MALAKOFF TO TRINIDAD-FOREST GROVE TRANSMISSION LINES

Land Use Category	Primary Route								
	Outside Power Plant Boundary			Inside Power Plant Boundary			Total		
	ha	ac	%	ha	ac	%	ha	ac	%
Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial/ Industrial	0.66	1.62	2.95	0.00	0.00	0.00	0.66	1.62	1.99
Grazingland	3.61	8.81	16.06	0.00	0.00	0.00	3.61	8.81	10.82
Pastureland	10.25	24.99	45.57	6.63	16.16	60.77	16.87	41.15	50.53
Undeveloped Land	7.37	17.98	32.79	4.28	10.43	39.23	11.65	28.41	34.89
Water	0.59	1.44	2.63	0.00	0.00	0.00	0.59	1.44	1.77
TOTAL	22.48	54.84	100.00	10.91	26.59	100.00	33.38	81.43	100.00

Source: EH&A, 1980.

Five major oil and/or gas fields are located within or partially within the project area. Table 5-51 indicates oil and gas production figures for these fields. Approximately 164 wells have been located in the project areas (NACCO, 1982d). Oil wells account for 60 locations and gas wells for 49 locations. Additionally, approximately eight wells are potential producers but are currently nonproducing. Although only 88 percent of the oil wells in the Cayuga Field is located in the southern portion of the proposed mine area, approximately 84 percent of all oil produced in the mine area is produced in this field. The largest gas producing field is the Tri-Cities Field, located in the northeastern portion of the proposed mine area. Approximately 50 percent of the gas wells in the Tri-Cities field is located in the proposed mine area and producing about 49 percent of the gas reported for the project area.

Of the total mine area, only about 16,131 ha (39,345 ac) will be affected, consisting principally of pastureland. See Sec. 5.22.3 for additional information.

Several locations in the proposed mine area have been mined for sand and gravel. The sand and gravel operations are located in the alluvial area east of the Trinity River, which extends throughout the central portion of the western half of the area and is protected by the levee system. In 1960, the USGS Quad Sheet for the Creslenn Ranch depicted one large sand and gravel operation approximately 34 ha (82 ac) in size, and three smaller operations all less than 2.1 ha (5 ac) in size.

Sand and gravel operations are located in the alluvial area east of the Trinity River. This area contains approximately 5,166 ha (12,600 ac). Based upon the trend as depicted in Table 5-52, an average of 21 ha (50 ac) per year has been mined for sand and gravel during the past several years. If this trend continues at this rate, cumulative disturbance could be as great or greater than 1,025 ha (2,500 ac) in the year 2022, the expected closing of mine activities (see Table 5-52).

Areas identified as unsuitable for mining in accordance with Part 761, Section 071 of the Texas Coal Mining Regulations include Post Oak Cemetery, numerous unnamed county roads, Farm-to-Market Road 90, U.S. Highway 287, and several public buildings and occupied dwellings.

TABLE 5-51

OIL AND GAS PRODUCTION FIGURES IN THE PROPOSED MINE AREA[a]

Field Name	Total Gas in Project Fields (MCFG[b])	Percent of Wells Located in Project Area	Total Gas in Project Area (MCFG[b])	Total Oil in Project Fields (bbl[c])	Percent of Wells Located in Project Area	Total Oil in Project Area (bbl[c])
Cayuga	2,059,562	91	1,874,201	241,642	88	212,645
Malakoff	459,336	100	459,336	22,681	100	22,681
Tri-Cities	10,213,813	50	5,106,906	1,160	100	1,160
Trinidad	3,022,044	100	3,022,044	16,707	100	16,707
Loudy	6,648	100	6,648	0	100	0
TOTAL	15,761,403		10,469,135	282,190		253,193

a. For metric unit equivalent, please refer to metric conversion table located in the Glossary.

b. Thousand cubic feet of gas.

c. Barrels.

Source: Texas Railroad Commission, 1980.

TABLE 5-52
SAND AND GRAVEL PIT DISTURBANCE IN THE MINE AREA IN ACRES[a]

Source of Information	Year Available	Acreage Increase	Cumulative Acreage Disturbed
USGS Quad Sheet Creslenn Ranch	1960		82
SCS Soil Map for Henderson County	1973-1974	125	263
Aerial Photographs 1" = 400' maps prepared by Hildebrande	1979	61	324
Aerial Photographs flown by Aero Services	1981	104	428
Aerial Photographs flown by Tobin (six months later)	1982	38	466
Predicted Estimate of Disturbed Acreage (based upon an average of 50 ac/ year during the period of 1979-1982)	2000	900	1,366
Predicted Estimate of Disturbed Acreages at closing of mine activities	2022	1,100	2,466

a. For metric unit equivalent, please refer to the metric conversion table located in the Glossary.

Source: NACCO, 1982.

5.22.2 Impacts of No Action Alternative

If the proposed project were not constructed and operated, project land use would likely follow regional historic trends. However, since the changes which may occur over the next 35 years are determined largely by economics, the exact changes and the impacts associated with these changes cannot be quantified.

However, sand and gravel operations are expected to expand. Because there are no regulations regarding reclamation of sand and gravel mining, it is likely that only a small percentage of the area would be regraded and reclaimed by sand and gravel operators. Therefore, by the year 2022, which corresponds with mine closing activities, about 1,025 ha (2,500 ac) or more could remain in an unregraded/unreclaimed state.

5.22.3 Impacts of Project Alternatives

5.22.3.1 Construction Impacts

Power Station. The boundary of the generating station site encompasses a total of approximately 1,394 ha (3,400 ac). However, only a portion of this area will be disturbed. The site disturbance area of 437 ha (1,066 ac) includes the power plant, main and secondary access roads, access railroad spur, the raw water storage pond, other ancillary facilities (fly ash silo, materials handling, switch yard, buildings, etc).

Additionally, the overhead coal conveyor will span from the power station site to the mine silo, affecting approximately 3.4 ha (8.3 ac).

The transmission line right-of-way will disturb an additional 22.5 ha (54.84 ac). The portion of the makeup water pipeline outside the Malakoff EGS boundary that will be affected by construction activities includes approximately 312 ha (761 ac) of land. Following construction activities, only about 83 ha (203 ac) will be affected by the pipeline right-of-way.

During the construction phase, a total of about 775 ha (1,890 ac) (all power station related disturbances including transmission lines, makeup water pipeline and lignite conveyor) will be disturbed, of which approximately 444 ha (1,083.3 ac) is pastureland and about 309 ha (754 ac) is forested areas, not managed for wood or wood products. No significant impact will result from the conversion of this small acreage from its present land use to commerical/industrial.

Mine. Construction impacts of the proposed Trinity Mine will affect about 116 ha (283 ac), which includes the mine access road and combined mine facilities area. Construction impacts may also include temporary land disturbance on areas adjacent to ancillary activities. After mining ceases, these areas will be restored to existing or more productive conditions, unless otherwise approved.

5.22.3.2 Impacts of Operation

Power Station. With the exception of about 230 ha (560 ac) affected only during construction of the makeup water pipeline, the acreages affected during operation of the Malakoff EGS will be the same as discussed. Therefore, no significant land use impact is anticipated.

Mine. The proposed mine site area comprises 22,222 ha (54,200 ac) of land. Of the total site acreage, 8,802 ha (21,470 ac) will be disturbed and reclaimed at a rate of approximately 250 ha (611 ac) per year through the year 2022. An additional 7,329 ha (17,875 ac) will potentially be affected if mining progresses into other areas not required to be mined for the purpose of providing fuel for the Malakoff EGS. Current land uses in areas to be mined are: cropland, 283 ha (690 ac); improved pastureland, 7,641 ha (18,636 ac); unimproved pastureland, 1,987 ha (4,846 ac); forest land, 5,224 ha (12,742 ac); water, 197 ha (481 ac); and 90 ha (220 ac) of other minor land uses.

NACCO will not mine within 30.48 m (100 ft) measured horizontally of the Post Oak Cemetery and access to the cemetery will be maintained. If the right to mine has not been established on a tract of land, NACCO will not mine the tract or within 91.44 m (300 ft) measured horizontally from the occupied dwelling without a written waiver from the owner consenting to surface mining operations closer than 91.44 m (300 ft). Public roads and buildings will be relocated and/or reconstructed as negotiated with the appropriate government agency or landowners as set forth by the Texas Coal Mining Regulations Part 761, Sections 071 and 072.

The mining project will preclude other activities which are not required to reclaim land. A potential of about 1,025 ha (2,500 ac) of land affected by sand and gravel operations which would otherwise remain as a barren use will be reclaimed for agricultural uses following mining activities.

Since only 16,131 ha (39,345 ac) of the mine area will be affected by project activities, existing land cover will be maintained on the undisturbed area following the end of the project. Over the proposed 35-year life of the project, an average of 250 ha (611 ac) will be mined annually. A maximum of about 410 ha (1,000 ac) may be disturbed at any single point in time. Revegetation will meet the performance standards of the Texas Surface Coal Mining Regulations of 1981. If the Railroad Commission requires postmining land use to be similar to premining land uses, there will be little change in the productivity of the land. If the individual landowner's request alternative land uses and these requests are approved by the RRC, postmining land use changes will occur. Since the decision of postmining land use will be ultimately determined shortly before reclamation begins (from 5 to 40 years in the future, depending on the location of a particular parcel of land) the impact to land use cannot be accurately assessed. However, two alternative postmining land use scenarios have been evaluated by EPA: 1) return to premining vegetative cover and 2) a postmining vegetative cover of 100 percent pasture. Under either of these scenarios, postmining land use will continue to be dominated by livestock and hay production.

5.22.3.3 Cumulative

The Forest Grove mine and electric generating station is expected to undergo development in the two-county project area during a similar time period as the Malakoff EGS/Trinity Mine. No information concerning scheduling or areal extent is available. As discussed previously, oil and gas development is also expected to increase industrial uses over the life of the project through the year 2022. The population associated with this project will increase urban land uses through residential construction, accounting for approximately 5 to 10 percent of the regional growth expected without this project (see Sec. 5-15).

The effects of the Malakoff EGS/Trinity Mine on regional land uses can also be considered in terms of a comparison of the site characteristics and economically significant lands within the region. The Malakoff EGS/Trinity Mine Project will withdraw from use approximately 4.0 percent of the improved and unimproved pastureland in the two-county region in 1980. The project area accounts for approximately 2.3 percent of the total region's forest land. The withdrawal of pasturelands from use for the duration of mining and reclamation during the bond period will have a minimal effect upon the region's total livestock production. Based upon crop and livestock statistics for 1980, the average annual value per acre for livestock production is $86.20.

Based upon information received from a study conducted by Texas A&M University, the area has a potential timber production value of $68.76 per ha ($28.18 per ac) and a net income to owners value of $7.56 per ha ($3.10 per ac) assuming the highest level of production management (Texas A&M, 1978). Applying these estimates to the site forested land, it is estimated that the 5,224 ha (12,742 ac) of forest land on the project site could have a potential timber production value of $359,070 and a net income to owners of $39,500. Since currently none of the project area's forest lands are managed for production of wood or wood products, these figures do not represent an actual loss. In comparison, the regional growth resulting from the project in income is expected to be approximately $217 million annually during the construction phase and about $103.9 million annually during the operations phase for a 35-year period.

5.23 EFFECTS OF ALTERNATIVES AVAILABLE TO EPA

As discussed in Sec. 4.6, three alternatives are available to EPA in accordance with its regulatory and permitting authority pursuant to Section 402 of the Federal Water Pollution Control Act. These alternatives are to: 1) issue the NPDES permits as proposed; 2) issue the NPDES permits with conditional requirements or modifications based on anticipated project impacts; or 3) deny the issuance of the NPDES permits.

5.23.1 Issuance of Permits

The issuance of new source NPDES permits will allow HL&P and NACCO to operate the Malakoff EGS and Trinity Mine, respectively, as described in Chapter 4.0 and to discharge wastewater up to the limits set forth in the permits into the receiving waters identified in the permits.

The permits may be issued with conditional requirements or modifications which require additional monitoring and/or reporting to be undertaken during operation of the Malakoff EGS and/or the Trinity Mine to: 1) evaluate the effectiveness of pollution control systems; and/or 2) evaluate the significance of projected environmental impacts of operation, if warranted.

5.23.2 Denial of Permits

EPA could deny the respective NPDES permit if: 1) the discharges from the Malakoff EGS or the Trinity Mine violate effluent limitations, and/or water quality standards; 2) discharges are found to have an unacceptable significant adverse impact on the human environment; or 3) if environmental considerations such as endangered species, historic and/or archaeological sites, prime farmland, etc., are significantly affected, and measures intended to mitigate adverse impacts are determined unacceptable. Denial of the permit(s) would likely result in the applicant(s) not constructing or operating the facilities as described in Chapter 4.0, and no effluent discharged into the locations described in the preliminary draft permits (Appendix B). Should the NPDES permit(s) not be issued by EPA, the applicant(s) would have the options of: 1) modifying the project to avoid or mitigate unacceptable environment harm and resubmitting the permit application; 2) locating and evaluating another project; or 3) pursuing the no-project alternative.

5.24 EFFECTS OF ALTERNATIVES AVAILABLE TO OTHER PERMITTING AGENCIES

Permits other than the NPDES permit required for the Malakoff EGS and the Trinity Mine are included in Table 3-1. Issuance of permits by other permitting agencies would allow the project to be operated as described in Chapter 4.0. Denial of the permit could cause modification to the project or require the applicant(s) to evaluate other alternatives, including the no-project alternative.

6.0 COORDINATION

Coordination with other Federal agencies, State agencies and the public is set forth in EPA's implementation procedures on NEPA (44 FR 64174-64193) and in public participation final regulations (44 FR 10286-10297).

6.1 SCOPING PROCESS

On February 11, 1982, EPA issued a Legal Notice in the Malakoff News, and on February 14, 1982, EPA issued a Legal Notice in the Athens Review. The purpose of the notices was to announce EPA's intention to prepare a "tiered" EIS for the Malakoff Generating Station and the Trinity Mine. On March 18, 1982, EPA conducted a Scoping Meeting in Malakoff, Texas, to solicit public input for the generating station EIS. A Responsiveness Summary for that meeting, which discussed the comments of the public, was prepared by EPA and distributed to interested parties on May 12, 1982. After the March 16, 1982, meeting, based on requests made by the applicants, EPA decided to prepare one EIS to discuss both the mine and the generating station. A second Notice was published in the Malakoff News on May 6, 1982 announcing a second Scoping Meeting. A public Scoping Meeting was conducted on June 7, 1982, in Cross Roads, Texas. A Responsiveness Summary for the June 7 meeting was prepared by EPA and distributed to interested parties on June 29, 1982. Copies of the Notices of Intent (NOI) and Responsiveness Summaries are included at the end of this Chapter.

6.2 INTER-AGENCY COORDINATION

The following agencies are cooperating agencies and, as such, provide assistance and expertise during the preparation of the EIS: U. S. Department of Agriculture, Soil Conservation Service; U. S. Department of the Interior, Fish and Wildlife Service; U. S. Army Corps of Engineers; Texas Historical Commission; U. S. Department of the Interior, Office of Surface Mining; Railroad Commission of Texas; Texas Air Control Board; Texas State Department of Highways and Public Transportation; Texas Parks and Wildlife Department.

6.3 EIS REVIEW PROCESS

Upon notice of availability of this Draft EIS in the Federal Register, a 45-day comment period is initiated during which comments are solicited from Federal, State and local agencies, from the applicant and from the public. A public hearing will be scheduled. Comments received during the comment period and public hearing will be responded to by EPA in the Final EIS. The Final EIS will be distributed only to those persons who have commented on the draft or who have specifically requested a copy of the Final EIS. The Final EIS will have a 30-day comment period, after which EPA can issue a record of decision on the NPDES permit action.

6.4 DISTRIBUTION LIST

(List is presented on following pages.)

MAILING LIST FOR THE DRAFT EIS
FOR THE
PROPOSED MALAKOFF EGS/TRINITY MINE

Federal Agencies

Honorable Lloyd Bentsen, U. S. Senate, Washington, DC
Honorable John Tower, U. S. Senate, Washington, DC
Keith Olson, U. S. Bureau of Mines, Twin Cities, MN
U. S. Coast Guard, 8th District, New Orleans, LA
Central Region, U. S. Geological Survey, Denver, CO
Federal Emergency Management Agency Region VI, Denton, TX
Regional Manager, Office of Coastal Management, Washington, DC
Bureau of Land Management, Santa Fe, NM
U. S. Dept. Health, Education and Welfare;
  Public Health Service Center for Disease Control, Atlanta, GA
U. S. Dept. of Transportation, Environ. Analysis Division, Washington, DC
Office of Legislation, EPA (A-102), Washington, DC
Office of Env. Project Review, U. S. Dept. of Interior, Washington, DC
Deputy Asst. Sec'y for Env. Affairs, U. S. Dept. of Commerce, Washington, DC
Asst. Sec'y for Env. and Urban System, U. S. Dept. of Transportation, Washington, DC
Environmental Quality Acts., Office of the Sec'y Dept. of Agriculture, Washington, DC
Water Resources Council, Washington, DC
Farmer's Home Administration, Washington, DC
Agricultural Stabilization and Conservation Service, Washington, DC
Director, Office of NEPA Affairs, Washington, DC
J. Heineman, Federal Energy Regulatory Commission, Washington, DC
National Wetlands Technical Council, Washington, DC
Advisory Council of Historic Preservation, Washington, DC
Office of Federal Activities, Washington, DC
Edward Pickering, U. S. Dept. of the Interior Geological Survey, Reston, VA
Federal Emergency Mgmt Agency, Region VI, Denton, TX
Regional Planner, U. S. Forest Service, Albuquerque, NM
Dir., Dallas Support Office, U. S. Dept. Energy, Dallas, TX
Dir., Env. Impact Office, EPA, Region I, Boston, MS
Regional EIS Coordinator, EPA, Region III, Philadelphia, PA
U. S. Dept of Energy EP-361, Washington, DC
Chief, EIS Prep Unit, EPA, Region IV, Atlanta, GA
Regional EIS Coordinator, EPA, Region 7, Kansas City, MO
EIS Review Coor., EPA Region IX, OPRM-2, San Francisco, CA
Regional Env. Officer, Dept. of Interior, Albuquerque, NM
Chief Env. Anal. Branch, Office of Surface Mining, Western Tech. Service Cen.,
  Denver, CO
U. S. Bureau of Mines, Intermountain Field Oper., Denver, CO
Dir., Office Env. Project Review, U. S. Dept of Interior, Washington, DC
U. S. Dept. of HUD, Ft. Worth, TX
Chief, Planning Section, AWS-611, FAA, Ft. Worth, TX
National Park Service, Outdoor Rec. Planner, Albuquerque, NM
Office of Env. & Safety, Asst. Sec., Policy & Internal Affairs, DOT, Washington, DC
Chief, Div. of Env. Serv., National Park Service, Santa Fe, NM
Chief, Env. Activ. Branch, Agri. Stab. & Conserv. Serv., Washington, DC
Office of Env. & Design, Fed. Hwy Admin., Ft. Worth, TX
Terry S. Siemsen, Attn: ORLPD-R, U. S. Army Corp of Eng., Louisville, KY

Joseph B. Smith, Chief, Bureau of Mines, Denver, CO
Ernest T. Baker, Jr., U. S. Geological Survey, WRD, Austin, TX
Chief, A&E Branch, ROFEC VI, U. S. Dept. Health & Human Serv., Dallas, TX
Regional Engineer, Federal Energy Reg. Comm., Ft. Worth, TX
Administrator, Office of Surface Mining, Denver, CO
State Programs Mgmt Branch, EPA Region VIII, Denver, CO
Reg. Dir., U. S. Fish & Wildlife Serv., Albuquerque, NM
Area Mgr, Environment, U. S. Fish & Wildlife Serv., Austin, TX
Commander (MEP), 8th Coast Guard District, New Orleans, LA
Env. Specialist, U. S. Fish & Wildlife Serv., Atlanta, GA
Chief, Planning & Env. Coord., Bureau of Land Mgmt, Santa Fe, NM
Reg. Environ. Coord., U. S. Forest Service, Atlanta, GA
District Chief, Water Resources Div., USGS, Austin, TX
U. S. Geological Survey, Austin, TX
U. S. Dept. of Agri., Soil Conservation Service, Temple, TX
Regional Env. Affairs Off., U. S. Bureau of Reclamation, Amarillo, TX
Attn: Linda McKee, Honorable Lloyd Bensten, U. S. Senate, Austin, TX
Staff Asst., Honorable John Tower, U. S. Senate, Houston, TX
Ex. Sec. - Nat. Res. & Env., USDA, Washington, DC
Gulf/islands Reg. Mrg., Office of Coastal Zone Mgmt.,
  NOAA/U. S. Dept. of Commerce, Washington, DC
Chief, Env. Resources, SW Division Corps of Eng., Dallas, TX
Division Engineer, SW Div.-Corp of Eng., Dallas, TX
Chief, Env. Research Branch, Corps of Eng.-Tulsa Dist., Tulsa, OK
Legislative Aide, Honorable John Tower, U. S. Senate, Washington, DC
Chief, Env. Resources Sect., U. S. Army Corp of Eng., Ft. Worth, TX
Chief, Env. Affairs Group, Center for Disease Control, Dept. of Health & Human Serv.,
  Atlanta, GA
Frank S. Lisella, PhD, Centers for Disease Control, Athens, TX
Chief, Planning Div., Tulsa Dist., COE - Tulsa, OK
Marion S. Porter, Soil Conservation Service, Terrell, TX

State Agencies

Dept. of Health & Human Serv., Reg. 6, Public Health Ser., Div. Prev. Health Ser., Dallas, TX
Director, N. M. Dept. of Agri, Las Cruces, NM
Head of Env. Divisin, Ark. State Hwy & Trans. Dept., Little Rock, AR
Frank T. Nagle, General Counsel, Federal Land Bank of TX, Austin, TX
Joseph F. Thiel, Texas Dept. of Health, Austin, TX
John E. Hutchison, Texas Dept. of Agriculture, Austin, TX
LaVerne Herrington, PhD, Deputy State Historic Preservation Officer, Texas Historical Comm, Austin, TX
Darla Parker, Governor's Budget & Planning Office, Austin, TX
Dr. Alfred J. D'Arezzo, Texas Dept. of Water Resources, Austin, TX
James M. Moore, Engineer, Texas State Soil & Water Conservation Board, Temple, TX
James R. Evans, Dist. Eng., State Dept. of Hwys & Public Transportation, Tyler, TX
D. L. Houston, P. E., Texas Dept. of Health, Austin, TX
R. L. Lewis, Chief Eng. of Hwy design, Austin, TX
Carl Frentress, Texas Parks & Wildlife Dept., Athens, TX
Chief, Communications, Arkansas Dept. of Pollution Control & Ecology, Little Rock, AR
Surf. Mining & Recl. Div. RCC of Texas, Austin, TX
Exec. Dir., Texas Parks & Wildlife Dept., Austin, TX
Dir., Resource Conser., Texas Hist. Comm, Austin, TX
Dir., Div. of Environ. Protection, AR Dept of Health, Little Rock, AR
Honorable Bill Clements, Governor of Texas, Austin, TX
Texas Energy & Natural Resources Council, Austin, TX
Exec. Dir., Texas Air Control Board, Austin, TX
Director EOD, Texas Dept. Community Affairs, Austin, TX
Dir., Agri & Env. Sciences, Texas Dept. of Agri., Austin, TX
Texas State Soil & Water Conservation Board, Temple, TX
George Nigh, Governor of Oklahoma, OKC, OK
Commissioner of Health, Texas Dept. Health Res., Austin, TX
Horace J. Thibodaux, Dir. of Env. Research, Houma, LA
Project Mgr., LA Env. Protection Assoc., Metairie, LA
A-95, EIS Review Coord., Gov. Office of Planning & Budget, Austin, TX
Texas Dept. of Water Resources, Austin, TX
Texas Dept. Hwy & Public Trans., Austin, TX
Asst. Attorney General, LA Dept. of Justice, Baton Rouge, LA
State Director, FmHA, Temple, TX

Regional/Local Agencies

Martin Clauservitz, City Public Serv., San Antonio, TX
Jack T. Rife, Atty, Henderson City Levee Dist. #3, Athens, TX
Jim Blakeney, Commissioner, Athens, TX
East Texas Council of Governments (COG), Kilgore, TX
Jack L. Ward & Assoc., County Surveyor-Henderson Co., Athens, TX
Begie Darden, Cross Roads Elem. School, Malakoff, TX
Ernest L. Jenkins, City of Trinidad, Trinidad, TX
Victor J. Hancock, Regional Dir. for CPD, Ft. Worth, TX
Dr. Wm. J. Campion, Henderson Co. Jr. College, Athens, TX
R. W. Lawrence, Dist. Judge, Palestine, TX
Jack H. Holland, Judge 173rd Dist. Court, Athens, TX
Winston Reagan, County Judge, Athens, TX
Chairman, SW Fed. Reg. Council, Dallas, TX
Dir. of Land Resources, Continental Forest Ind., Stamford, CT
City Mgr., City of Malakoff, Malakoff, TX

Public Interest Group

Colorado State Univ. Library, Ft. Collins, CO
Donna M. Lestage, Tyler Morning Telegraph, Tyler, TX
Garry Gibbons, Palestine Herald-Press, Palestine, TX
Mrs. Nannie Drake, President-Malakoff Area Chamber of Commerce, Malakoff, TX
Alan Allen, Exec. Dir., Sportsmen's Clubs of Texas, Austin, TX
Joe Short, KBUD Radio, Athens, TX
Athens ISD, C. C. Baker, Jr., Athens, TX
Ann Rounsaually, The Malakoff News, Malakoff, TX
Mr. Ernest Jenkins, Trinidad Chamber of Commerce, Trinidad, TX
Don McKinnerney, Cross Roads ISD, Malakoff, TX
Mark W. Smith, Veterans Land Board, Austin, TX
Norman E. Plemons - Superintendent of Schools, Malakoff ISD, Malakoff, TX
Laura Albrecht, Corsicana Daily Sun, Corsicana, TX
Sec/Treas. Izaak Walton League, Albuquerque, NM
Common Cause, Austin, TX
Coord., Toxic Substances Task Force, Citizens Env. Coalition, Houston, TX
Jerry Canter, Professor, University of Oklahoma, Norman, OK
Audubon Society - SW Region, Brownwood, TX
Conservation Chairperson, Sierra Club of TX, Houston, TX
Exec. Dir., Sportsmen's Club of Texas, Austin, TX
Chief Organizer, ACORN, New Orleans, LA
Clean Air & Water, Inc., Beaumont, TX
Water Director, League of Women Voters, Dallas, TX
Lone Star Chapter, Sierra Club, Austin, TX
Inst. Env. Studies, Baylor Univ., Waco, TX
Catherine Perrine, League of Women Voters, Dallas,TX
National Wildlife Fed., Washington, DC
Southcentral Representative, Wildlife Mgmt. Institute, Dripping Springs, TX
Supervisor of Env. Affairs, Beautify Texas Council, Dallas, TX
Editor, Texas Archeological Society, Dublin, TX
Dir., Texas Water Resources Inst., TAMU, College Station, TX
Texas Comm on Natural Resources, Dallas, TX
Texas Conservation Council, Houston, TX
Texas Environmental Coalition, Austin, TX
Community Affairs Chairman, American Assoc. Univ. Women, Alpine, TX
Sierra Club, Dallas, TX
American Field Rep., American Wilderness Alliance, Denver, CO
Environmental Defense Fund, Washington, DC
Env. Law Institute, Washington, DC
Office Mrg., Rnv. Defense Fund, Washington, DC
Regional Dir., National Wildlife Red., Norman, OK

Interested Citizen

James D. Anders, Malakoff, TX
John Grizzard, Lynwood, CA
Robert Almond, Dallas, TX
G. E. Asher, Athens, TX
Roland D. Lancaster, Dallas, TX
Sandra J. Kinney, Sandy, UT
Charley D. Duncan, Odessa, TX
Charles Day, Malakoff, TX
Katherine F. Welch, Malakoff, TX
J. A. McLain, Malakoff, TX
Jim Blakeney, Malakoff, TX
Karl E. Nichols, Malakoff, TX
Mrs. Norine M. Wood, Sugar Land, TX
Brink R. Barnett, Malakoff, TX
Alyne W. Frost, Asheville, NC
Rev. Huey Clements, Methodist Minister, Malakoff, TX
Charles Hewn, Athens, TX
Ben Johnson, Athens, TX
Mrs. Lovie M. Whitaker, Alpine, TX
W. A. Allen, Jr., Adkins, TX
Dr. Theodore P. Brendle, Malakoff, TX
Steve Lamb, Malakoff, TX
Billy C. Norwood, Malakoff, TX
Doris E. Green, Tyler, TX
Vernon Coffer, Duncan, OK
Kay Mattingly, Malakoff, TX
Greg Densmore, Cedar Creek Pilot, Kemp, TX
Mr. Marion Butler, Chief, Env. Div., Little Rock, AR
Philip R. Bishop, Ft. Worth, TX
John A. Buchanan, Athens, TX
H. S. DeArman, Malakoff, TX
James Simmons, Jr., Lancaster, TX
Lewis D. Vievegge, Malakoff, TX
L. J. Loper, Athens, TX
S. R. McGintey, Elkhart, TX
Norris E.Holt, M. D., Athens, TX
H. H. Cade, Malakoff, TX
Mrs. Eva Zee McGensey, Dallas, TX
F. Thomas Dean, Dallas, TX
Lester Turlington, Pasadena, TX
Richard D. Young, Houston, TX
Mr. Andrew Gibbs, Mabank, TX
John C. Eckert, Mason, TX
Lois Litchfield, Malakoff, TX
J. E. Hejt, Fairfield, TX
Mr. & Mrs. Paul Power, Malakoff, TX
Mrs. Roma Jo Mayes, Malakoff, TX
A. Y. Harper, Ocean Springs, Mss
Bobby L. Plaster, Houston, TX
Mr. Bobby W. Barton, Missouri City, TX
Jimmy & Dorothy Dyke, Ft. Worth, TX

M. C. & Ollie Pearl Turlington, Malakoff, TX
Ruby Rogers, Postmaster, Malakoff, TX
Clyde H. Alexander II, Creslenn Ranch, Trinidad, TX
Herman & Letha Moore, Malakoff, TX
Albert B. & Minnie H. Page, Dallas, TX
Lilyan J. Reeves, Dallas, TX
Charles F. Kelly, Dallas, TX
J. W. Jr & Louise Sparks, Cayuga, TX
Rex B. Smith, El Paso, TX
Ruby Floyd, Pittsburg, CA
Thomas M. Matthews III, Corpus Christi, TX
L. W. & Edna Parks, Trinidad, TX
Kent Hervey, Corsicana, TX
Michael Horn, Dallas, TX
Helen Kihman, Malakoff, TX
C B "Bill" Bradshaw, Malakoff, TX
Bryan H. Thompson, ASLA, Tyler, TX
Carl W. Yardley, Lorenzo, TX
W. T. Turlington, Malakoff, TX
Billie L. Feranco, Clayton, CA
Mary P. Shannon, Austin, TX
Staff Mg., Brown & Root, Houston, TX
Gladys Carter, NACCO & Getty Oil Co., Corsicana, TX
Wm. E. Malone, Malakoff Feed & Supply, Malakoff, TX
Dogle Loper, Malakoff High School, Malakoff, TX
Nelda J. Alexander, Middle South Services, Inc., Environmental Affairs Section, New Orleans, LA
I. P. Jenkins, Shell Oil Co., Houston, TX
Southern Company Services, Birmingham, AL
Dick Robertson, Texas Utilities Services, Inc., Dallas, TX
Jack McCool, McCool's Dept. Store, Malakoff, TX
Geoffrey Saunders, Getty Oil Co., Steamboat Springs, CO
Kent Crofts, Getty Oil Co., Steamboat Springs, CO
Gary Chitwood, Gen. Wgn., Holiday Inn, Athens, TX
James E. Hoelscher, Jr., University of Ark., Fayetteville, AR
Robert R. Steele, URS Co., Dallas, TX
Horace J. Thibodaux, R. E., T. Baker Smith & Son, Inc., Houma, LA
Richard Struble, Acres American Inc., Buffalo, NY
Judd & Company, Robert G. James, Ruston, LA
T. C. Showalter, Getty Oil Company, Salt Lake City, UT
Glid Galloway, Houston Lighting & Power Co., Houston, TX
M. D. Ward, Texas Clay Industries, Malakoff, TX
Robt. J. Whaley, Velvin & Weeks, Athens, TX
Carl Dean Atkins' Blue Mallard Gun Shop, Malakoff, TX
Jack Y. Hardee, Atty at Law, Athens, TX
Env. Licensing Dept. Southern Company Serv. Inc., Birmingham, AL
Cynthia Soule, City Public Serv. Board, San Antonio, TX
Stuart Frazer, Dallas, TX
John Cockrell, Dallas, TX
Bill Cartwright, Dallas, TX

PUBLIC NOTICE
SCOPING MEETING

The Environmental Protection Agency (EPA), Region 6, Dallas, Texas, will prepare an Environmental Impact Statement (EIS) to evaluate the impacts of the Malakoff Electric Generating Station and the nearby Malakoff-Cayuga surface mine near Malakoff, Texas. The electric generating station is being proposed by Houston Lighting and Power Company and would consist of two 600 megawatt units. The lignite would be supplied from lignite reserves held jointly by North American Coal Company and Getty Oil Company.

EPA recognizes the interdependence of the projects. However, since the power plant and the mine have significantly different construction schedules, EPA will use a tiered or staged approach for EIS preparation on this project. EPA will first prepare an EIS on the electric generating units and will subsequently prepare a supplement for the surface lignite mine. The decision made on the issuance of a National Pollutant Discharge Elimination System (NPDES) permit for the power plant will not obligate EPA in any way in its decision to issue an NPDES permit for the mine.

EPA will hold a public meeting to identify issues to be considered in the Draft EIS for the power plant at 7:30 p.m. at the Malakoff Elementary School Cafeteria on North Terry Street (one block north of Highway 31 on Farm Road 90) in Malakoff, Texas, on March 18, 1982.

This notice serves to implement EPA's policy of encouraging public participation in the decision-making process on EPA actions. EPA will involve the public in the environmental review to the maximum extent possible.

For further information contact:

Mr. Clinton B. Spotts
Regional EIS Coordinator
U.S. EPA, Region 6
1201 Elm Street
Dallas, Texas 75270
Telephone: (214) 767-2716

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE May 12, 1982

SUBJECT Responsiveness Summary, Scoping Meeting, March 18, 1981
Malakoff Electric Generating Station

FROM Clinton B. Spotts
Regional EIS Coordinator

TO Interested Agencies and Individuals

The Environmental Protection Agency (EPA) held a Scoping Meeting on March 18, 1982, in Malakoff, Texas, to solicit public input into the environmental issues that EPA should address in the Environmental Impact Statement (EIS) for the Malakoff Electric Generating Station proposed by Houston Lighting and Power Company. The power plant will consist of two 600 megawatt generating units located three miles southwest of Malakoff, Texas. Lignite will be supplied from the Trinity Mine owned jointly by North American Coal Corporation and Getty Oil Company.

This project was originally designed as a staged or tiered process. The Scoping Meeting, on March 18, 1982, was intended to focus on environmental concerns centering on the power plant. However, some issues were raised regarding the mine. Since the Scoping Meeting, the companies have accelerated their environmental and mining plans and have requested a total or joint EIS. Therefore, EPA will hold another Scoping Meeting to identify issues to be addressed on the Trinity Mine on June 7, 1982, at 7:30 p.m. at the Crossroads School Auditorium, Crossroads, Texas.

Environmental Issues

The following issues were raised at the Scoping Meeting and answered at that time. The table below reiterates the question, the response at the meeting, and how the issue will be treated in the EIS.

Issue	Response at Meeting	Treatment in EIS
Some state and county roads may be impacted by mine operation and power plant construction.	None	Will be addressed
How long will the students be gone when they are relocated due to mining?	Minimum of seven years.	Not addressed.
Where will mining begin?	The exact sequence has not been decided. Normally, mining begins where the deposit is shallowest. In this case, it would be west to east. However, other factors also enter into the decision.	Will be addressed in EIS.

What will be the source of water for the power plant?	Makeup water for the plant will be piped 43 miles from the Neches River to an on-site storage pond.	Will be addressed in EIS.
How long before mining occurs will the landowner be required to move?	The terms are spelled out in the lease agreement. Normally, its six months before mining.	Will not be addressed.
How many people will be needed for construction and operation of the power plant?	During the peak years, 1986 & 1987, there will be 2,400 construction and operation personnel. After construction is complete, there will be 200 to 250 operation's people.	Will be addressed in EIS.
Will there be a secondary water source for the power plant?	No.	Only the primary water source alternatives will be addressed in the EIS.
How will pumping water out of the mine pit impact the groundwater?	There are aquifers both above and below the lignite seams. Further testing and analysis will be required to determine if there will be any impacts and, if so, how extensive they will be.	Will be covered in EIS.
How many people will be needed to operate the mine?	400.	Will be covered in EIS.
What school district is the plant site in?	Malakoff.	Will be delineated in the EIS.
What arrangements will be made with people who haven't leased land yet?	Negotiations will continue. If an agreement cannot be reached, mining will proceed around the area.	Will not be covered in EIS.
Will any land be condemned?	The utility company can condemn land; however, someone more familiar with the condemnation process will have to answer the question.	Will not be addressed in the EIS.

Why wasn't there more notice and publicity for the meeting?	EPA placed a notice in the local newspapers 30 days before the meeting and mailed notices to Federal and State agencies, local officials and interested citizens.	Not addressed in EIS.
How much dust will the mine generate?	Control measures will be used to minimize dust.	Will be addressed in EIS.
Coal is backing up into a home where test wells are being drilled by the mining company.	Will investigate.	Will not be addressed in EIS.

NOTICE OF INTENT TO PREPARE
A COMBINED ENVIRONMENTAL IMPACT STATEMENT FOR
THE MALAKOFF ELECTRIC GENERATING STATION AND THE TRINITY MINE

BACKGROUND: On March 5, 1982, EPA issued a Notice in the FEDERAL REGISTER announcing its intention to prepare a "tiered" EIS for the Malakoff Electric Generating Station and the Trinity Mine. On March 18, 1982, EPA held a Scoping Meeting in Malakoff, Texas, to solicit public input for the generating station EIS. A Responsiveness Summary for that meeting is attached. Since that time, EPA has decided to prepare one EIS that will include the generating station and the mine. In light of this decision, EPA will hold another Scoping Meeting to solicit public input for the mine portion of the EIS.

AGENCY ACTION: Issuance of new source National Pollutant Discharge Elimination System (NPDES) permits to Houston Lighting and Power Company (HL&P) and a subsidiary of North American Coal Corporation for discharges from the Malakoff Electric Generating Station and the Trinity Mine, respectively.

OBJECTIVE OF EIS: To allow public input into EPA's decision-making process. To assist EPA in making its decision to issue, deny, or attach conditions to the NPDES permits. To determine the impact of the project on sensitive environmental resources, including air, water, prime farmland, wetlands, fish and wildlife, cultural resources, and socioeconomic conditions. To identify mitigation measures that can be employed by the applicants to reduce or eliminate significant environmental impacts. To fulfill EPA's obligations under the National Environmental Policy Act and the Clean Water Act.

TIMING OF EIS: EPA will prepare one EIS that will analyze the impacts of the generating station and the mine on the environment. The Draft will be distributed in November, 1982, and the public will be allowed 45 days to comment. All comments will be responded to in the Final EIS. After a 30-day comment period on the Final EIS, EPA will issue a Record of Decision.

PUBLIC MEETING: The public is invited to attend a meeting on June 7, 1982, at 7:30 p.m. at the Crossroads School Auditorium, intersection of state highways 90 and 59, Crossroads, Texas. Details of the mining project will be presented and the public is invited to identify issues that should be addressed in the EIS.

EPA CONTACT: Clinton B. Spotts, Regional Coordinator, U.S. EPA Region 6, 1201 Elm Street, Dallas, Texas 75270, telephone (214)767-2716.

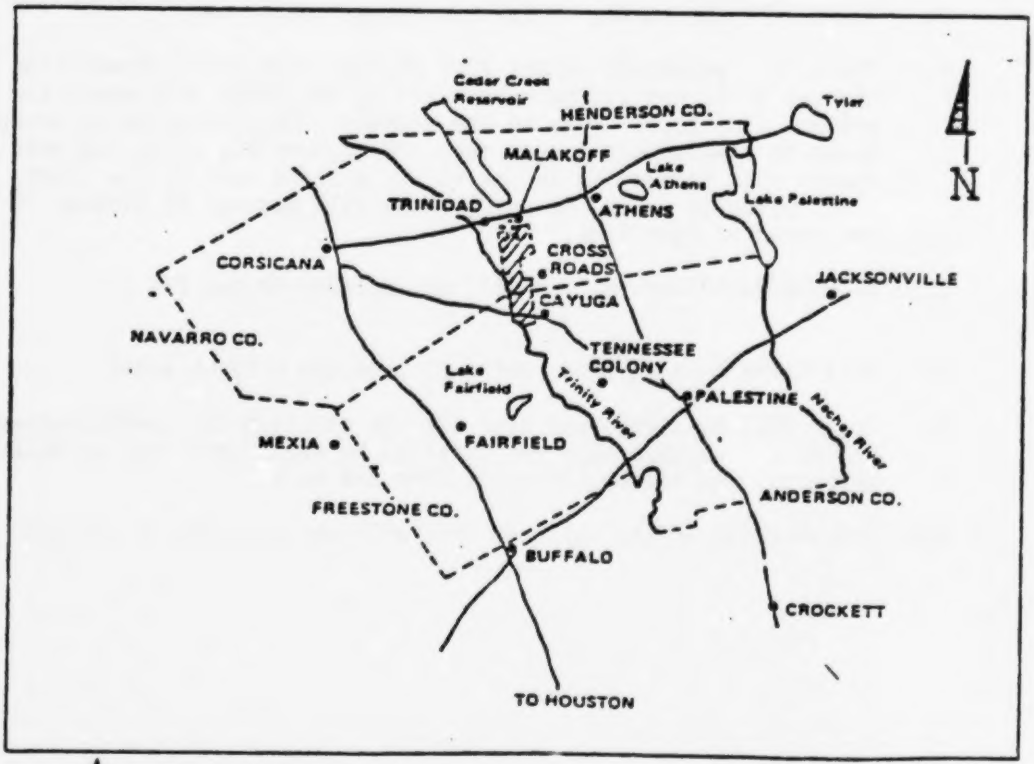
SUMMARY OF PROJECT: The proposed Malakoff Electric Generating Station will consist of two megawatt generating units located three miles southwest of Malakoff, Texas. Makeup water for the power plant will be supplied by the Upper Neches River Municipal Water Authority via a 43 mile pipeline from the Neches River to a storage pond on the plant site. The project will have transmission lines and a conveyor system to transport the lignite from the mine to the power plant. The lignite will be supplied from reserves held jointly by North American Coal Corporation and Getty Oil Company. The mine will cover 16,000 acres, mined at the rate of 500-600 acres per year and will supply 6.2 million tons of lignite per year to the generating station over a 30 year period.

ALTERNATIVES: (1) EPA issues a NPDES permit for the power plant as proposed or with modifications; (2) EPA denies the NPDES permit for the power plant; (3) EPA issues a NPDES permit for the mine as proposed or with modifications; and (4) EPA denies the NPDES permit for the mine.

RESPONSIBLE OFFICIAL:

Frances E. Phillips
Dick Whittington, P.E.
Regional Administrator

Attachment


Cedar Creek Reservoir
HENDERSON CO.
Tyler
MALAKOFF
Lake Athens
Lake Palestine
N
TRINIDAD
ATHENS
CROSS ROADS
CORSICANA
JACKSONVILLE
CAYUGA
NAVARRO CO.
TENNESSEE COLONY
Lake Fairfield
PALESTINE
Trinity River
Neches River
MEXIA
FAIRFIELD
FREESTONE CO.
ANDERSON CO.
BUFFALO
CROCKETT
TO HOUSTON

★ Power Plant Location

▨ Proposed mining area (not all of area shown will be mined)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: June 29, 1982

SUBJECT: Responsiveness Summary, Scoping Meeting, June 7, 1982
Trinity Lignite Mine

FROM: Clinton B. Spotts Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

TO: Interested Agencies and Individuals:

The Environmental Protection Agency (EPA) held a Scoping Meeting on June 7, 1982, in Crossroads, Texas, to solicit public input into the environmental issues that EPA should address for the Trinity Lignite Mine portion of the Environmental Impact Statement (EIS). The lignite reserves are held jointly by North American Coal Corporation (NACCO) and Getty Oil Company. The project area consists of 60,000 acres located in Henderson and Anderson Counties, Texas. The lignite will supply the Malakoff Electric Generating Station proposed by Houston Lighting and Power Company (HL&P).

The EIS will cover both the mine and the electric generating station. A Scoping Meeting for the Malakoff Electric Generating Station was held March 18, 1982, in Malakoff, Texas.

Environmental Issues

The following issues were raised at the Scoping Meeting and addressed at that time. The question (Q) or statement (S), the response (R) and treatment in the EIS are included below.

Q: Where will the access roads to the power plant be?

R: There is a permanent access road planned that will connect from Highway 31 to the northern boundary of the plant site where the project area comes close to the highway. Consideration is being given to a secondary access road off Highway 90, using the existing county road to provide access to the eastern part of the plant. The exact point at which the county road will connect to Highway 90 is not known at this time.

EIS: All available information will be included in the EIS:

Q: Will there be a railroad going through the project area?

R: There will be a railroad spur off the existing St. Louis/Southwestern Railroad line that will run parallel to the county road on NACCO's property, and access the plant from the east.

EIS: The location of the railroad spur will be described in the EIS.

Q: Will the land look the same after reclamation?

R: As it stands now, the land will generally look the same. For example, where there are rolling hills now, there will be rolling hills. Water management and wildlife habitat will also be given consideration in the total reclamation scheme. Specific areas will not appear the same in the future.

EIS: Both existing and post-mining land use will be described in the EIS and the impacts of any changes in land use will be thoroughly analyzed.

Q: How will mining affect our water table and our wells?

R: If your well is in a shallow water table above the lignite, it will be mined through. If your well goes below lignite, it will probably not be affected. Railroad Commission Regulations require NACCO to provide an alternate water source to replace any existing water sources that are disturbed by mining.

EIS: Existing and post-mining hydrology will be presented in the EIS and any impacts thoroughly analyzed.

Q: How long after mining will the land be turned back to the owners?

R: From the time NACCO takes possession of the land, it will be out of production for approximately seven years.

EIS: Not covered in EIS.

Q: What will you do with the water in the mine pit? Will it be pumped back into the ground?

R: The water will go into retention ponds to undergo sufficient treatment so that, when the water is released, it will meet all the existing water standards. The water will not be pumped back down into the ground.

EIS: Water treatment will be covered in the NPDES permit and the EIS.

Q: How many years will it take before I can build a house on reclaimed soil? I was told that it would be ten years.

R: Settling studies done by Texas A&M University on post-reclamation soils near Fairfield, Texas conclude that after the land has been reclaimed, revegegetated, and held through the five year bonding period, the land would settle only an additional three inches in 140 years. Consideration, however, should be given to the specific location where the home is to be built.

EIS: Will be covered in EIS.

Q: How will coal dust affect the people around the periphery of the mining operation?

R: NACCO will use processes such as watering down and revegetation to prevent erosion and dust. Occassionally there may be dust, but NACCO will try to control it as much as possible.

EIS: This will be discussed in the EIS.

Q: What about noise from the mining area?

R: In the past, most complaints have referred to the back-up alarm on the heavy equipment required for safety. Buffer zones will be observed near residences.

EIS: Will be discussed in EIS.

Q: Will access and utilities to my property be maintained?

R: Many transmission lines and roads will be relocated; however, road access and utilities will be maintained to all residents.

EIS: Will be discussed in EIS.

Q: Are all 60,000 acres leased?

R: No, not at this time.

EIS: Will be discussed in EIS.

Q: What criteria will determine when mining begins?

R: Normally mining begins in areas with the shallowest lignite deposits. Another factor is the distance from the power plant. Mining will begin in the northwestern quadrant.

EIS: Will be discussed in the EIS.

Q: How much dust and noise will there be from the power plant?

R: Just as the mine, the power plant will have an ongoing program to control dust and noise.

EIS: This will be discussed in the EIS.

Q: What about dust fallout from coal-burning during operation of the plant?

R: This is a clean air area, and the regulations limit the level of pollution so that it will not significantly degrade the air quality in the area. HL&P must obtain a PSD (prevention of significant deterioration) permit, which will specify the levels the plant will be allowed to emit. Emissions from power plants of this type are generally not the type you see. Over 99 percent of the particulate matter will be removed by precipitators and scrubbers before it leaves the stacks. Tall stacks will also disperse the emissions high into the atmosphere as a warm, steamy vapor.

EIS: Will be covered in the EIS.

Q: What are the air pollution limits allowed by the permit?

R: There are annual, daily, and three-hour standands that must be met.

EIS: Specific limits will be stated in the permit and in the EIS.

Q: Are the scrubbers to be used a caustic-type scrubber, and if so, how will the by-products be disposed of?

R: The exact type of scrubber is not known at this time, but that information can be provided to you. There is a sludge from the scrubber material that will be combined with the ash, becoming a concrete-like material that will be buried, covered, and seeded.

EIS: By-products will be identified and disposal impacts analyzed.

Q: What about pollutants we can't see?

R: Air quality standards are based on health so that if a plant meets their permit requirements, there should be no effect on health from those pollutants that are regulated.

EIS: Both regulated and non-regulated pollutants will be identified in the EIS and their impacts will be analyzed.

Q: Some lakes in the northeast part of the country have become acidic from air pollution and fish have died. What will happen to our lakes with this increase in pollution?

R: We don't really know everything about acid rain. We can't guarantee that there will or will not be an effect. The Texas Energy and Natural Resources Council conducted a study about acid rain in Texas. They concluded that there just wasn't enough information available, so they began to establish a network throughout the State that will supply the information needed to make these decisions.

EIS: The most current information about acid rain and its effects will be presented in the EIS.

Q: Will there be any odors associated with the power plant or the mine?

R: There should not be any odors from the power plant. The odors from the mine will be limited to the exhaust from the equipment being used.

EIS: Will be discussed in the EIS.

Q: What will be done with the trees on the land to be mined?

R: If the timber is of commercial value, we plan to harvest it in cooperation with the local people. Other timber will be burned or buried.

EIS: Will be discussed in the EIS.

Q: Will trees be put back where they are now?

R: Not necessarily. NACCO will work with the Railroad Commission and the individual landowners on specific sites.

EIS: General information on post-mining vegetation will be included in the EIS, but specific sites will not be discussed.

Q: Within the last few years we've had an increasing number of stacks in the area. Is there a limit on this?

R: There will be a section in the EIS that deals with cumulative effects of the air pollution sources. The issue of cumulative impacts is also addressed by the PSD permit system. As long as this system is in effect, there is a cutoff point in the level of pollution allowed.

If an industry wants to move into an area, but will cause the area to overstep the limit on pollution, the industry will not be allowed to move in.

EIS: Will be discussed in the EIS.

Q: Will the landowner get to choose what is put back on his land?

R: That will be decided on a lease-by-lease basis. The Texas Railroad Commission will also be monitoring what is put back on individual property. If you have questions as to a particular tract of land, talk to NACCO's land agent in Athens.

EIS: Details will not be covered in the EIS.

Q: How close to the Trinity River will you be mining?

R: Mining will be done almost entirely inside the existing levee along the river. There are plans to mine through portions of the upland levee, but the levee will be reestablished concurrently with mining and drainage will be maintained.

EIS: Will be discussed in the EIS.

Q: What is the life expectancy of the power plant?

R: Thirty to thirty-five years.

EIS: Will be discussed in the EIS.

Q: Are there any plans to expand further east with the mine?

R: Not at this time.

EIS: The mining area boundaries will be identified in the EIS.

Q: What about the two cemetaries involved?

R: There are no plans to mine through a cemetary.

EIS: Will be discussed in the EIS.

Statement by the Texas Highway Department: There are a number of state highways involved in the mining area. Issues concerning the relocation and/or upgrading of these roads will be resolved between NACCO and the Texas Highway Department. A request for the extension of FM 1667 on the western side of the project area which is in conflict with NACCO's interests is under consideration at this time.

Statement by the Texas Railroad Commission: The Texas Railroad Commission's regulations concerning mining activities forbid mining disturbance within 300 feet of a residence. There are similar zones for cemetaries and highways.

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8.0 BIBLIOGRAPHY

Alexander, G. B. 1976. Performance report, northeast Texas game management survey. Texas Parks and Wildlife Dept., Austin.

Baldwin, J. L. 1973. Climates of the United States. U.S. Dept. of Commerce. Washington, D.C.

Beck, H. HL., et al. 1980. Perturbations on the Natural Radiation Environment Due to the Utilization of Coal as an Energy Source. Environmental Measurements Laboratory, U. S. Department of Energy. New York, New York.

Blair, W. F. 1950. The biotic provinces of Texas. Tex. J. Sci. 2:93-117.

Bos, P. B. 1980. Other electric energy sources: their role and problems. In: A technical assessment of nuclear power and its alternatives. American Nuclear Society, Inc., La Grange Park, IL.

Bryson, H. L. 1973. Early survival and total height, and foliar analyses of eleven tree species grown on strip mine spoils in Freestone County, Texas. Stephen F. Austin State University, Nacogdoches, Texas.

Bureau of Economic Geology. 1975. Geologic Atlas of Texas - Dallas Sheet, Palestine Sheet, Tyler Sheet and Waco Sheet, University of Texas.

Butler, S. 1982. Personal communication. ERA Realtors, Palestine, Texas.

Catling, P. M. and K. L. McIntosh. 1979. Rediscovery of Sprianthes parksii Correll. Sida 8(2):188-193.

Chalmers, J. and E. Anderson. 1977. Demographic and economic assessment manual.

Core Laboratories, Inc. 1982. Coal Analysis Report, No. C82111, July 20, 1982.

Correll, D. and M. C. Johnston. 1970. Manual of vascular plants of Texas. Texas Research Foundation, Renner, Texas.

Davis, W. B. 1974. The mammals of Texas. Tex. Parks and Wildl. Dept., Bull. 41. 3rd ed. 294 pp. Austin, Texas.

Denver Research Institute. 1979. Socioeconomic impacts of western energy resource development.

Environment Consultants, Inc. 1982a. Quantitative vegetation survey of the Trinity Mine, Henderson and Anderson counties, Texas. Biol., Serv. Rpt. 82-5. Revised.

_____. 1982b. Wetlands determination of the Trinity Mine, Henderson and Anderson counties, Texas Biol. Serv. Rpt. 82-4.

_____. 1982c. Threatened and endangered species of the Trinity Mine, Henderson and Anderson counties, Texas. Biol. Serv. Rpt. 82-6.

Espey, Huston & Associates, Inc. 1978. Baseline survey of the terrestrial ecology of the Malakoff-Cayuga Mining Prospect. EH&A Doc. No. 78165.

_____. 1979. Reclamation Demonstration and revegetation plan for the Malakoff-Cayuga Prospect. Espey, Huston & Associates, Dallas, Texas.

_____. 1982a. Surface-water hydrology of the Malakoff Electric Generating Station, Henderson County, Texas. EH&A Document No. 81285.

_____. 1982b. Baseline survey of the terrestrial ecology of the Malakoff Electric Generating Station. EH&A Doc. No. 81253.

_____. 1982c. Soils, vegetation, and land use of the Malakoff Electric Generating Station makeup water pipeline. EH&A Doc. No. 82349.

_____. 1982d. Route selection and preliminary evaluation of the proposed Malakoff to Trinidad-Forest Grove Transmission Lines. EH&A Doc. No. 82334.

_____. 1982e. Endangered and threatened species biological assessment of the Malakoff Electric Generating Station, Henderson County, Texas. EH&A Doc. No. 82351.

_____. 1982f. Endangered and threatened species biological assessment of the Trinity Mine, Henderson and Anderson counties, Texas. EH&A Doc. No. 82352.

_____. 1982g. Endangered and threatened species biological assessment of the Malakoff Electric Generating Station Makeup Water Pipeline, Henderson and Anderson counties, Texas. EH&A Doc. No. 82353.

_____. 1982h. An Archaeological Survey and Assessment of the Malakoff Electric Generating Station Site Survey Area, Henderson County, Texas. EH&A Doc. No. 81190.

_____. 1982i. Acid deposition in Texas: technical summary and perspective. EH&A Doc. No. 81305. Austin, Texas.

_____. 1982j. Noise baseline, Malakoff Electric Generating Station. EH&A Doc. No. 81258.

_____. 1982k. Land use baseline, Malakoff Electric Generating Station. EH&A Doc. No. 81259.

Federal Insurance Administration. 1977. Flood hazard boundary maps, Henderson County, Texas, unincorporated area. U. S. Government Printing Office, Washington, D. C.

_____. 1979. Flood insurance rate maps, cities of Malakoff and Trinidad, Texas. U. S. Government Printing Office, Washington, D. C.

Federal Radiation Council. 1960. Background Material for the Development of Radiation Protection Standards, Report No. 1. U.S. Government Printing Office, Washington, D.C.

Fresquez, P. R. and W. C. Lindemann. 1982. Soil and rhizophere microorganisms in amended coal mine spoils. Soil Science Society of America Journal 46:751-755.

George, R. R. 1981. Statewide Mourning Dove research. Fed. Aid Proj. No. W-95-R-16. Job No. 1: Density, distribution and movement. Tex. Parks and Wildl. Dept., Austin, Texas.

Golden, J. et al. 1980a. Environmental impact data book; "Crime in the U. S.," Uniform Crime Reports, FBI (1975).

_____. 1980b. Environmental impact data book; "Special analysis K," HEW (1976).

_____. 1980c. Environmental impact data book; "Infrastructure and highway support needs of regions affected by energy activity," Watson, J. (1977) MITRE Corp. tech. rep. M58.

_____. 1980d. Environmental impact data book.

Gore, H. G. 1978a. Upland game investigations. Fed. Aid Proj. No. W-108-R-1. Job No. 1: Upland game harvest recommendations. Tex. Parks and Wildl. Dept., Austin.

_____. 1978b. Upland game investigations. Fed. Aid Proj. No. W-108-R-1. Job No. 3: Situate upland game transplants. Tex. Parks and Wildl. Dept., Austin.

Gould, F. W. 1975. Texas plants -- a checklist and ecological summary. Texas A&M Univ., Tex. Agric. Exp. Stn., College Station. MP-585/Rev. 121 pp.

Grue, C. E. 1977. Classification, inventory, analysis, and evaluation of the breeding habitat of the Mourning Dove in Texas. PhD. dissertation., Texas A&M Univ., College Station. 187 pp.

Guyton, W. F. and Associates. 1972. Ground-water condition in Anderson, Cherokee, Freestone, and Henderson counties, Texas. Texas Water Development Board. Report 150.

Harwell, W. F. and H. G. Gore. 1982. Big game investigations. Fed. Aid Proj. No. W-109-R-5. Job No. 1: Whitetailed Deer population trends. Tex. Parks and Wildl. Dept., Austin, Texas.

Hatzenbuehler, R. 1947. A net sinker site near Trinidad, Texas. The Record 6:14.

Hays, T. R. and Richard E. Larson. 1978a. Cultural Resource Survey in the Malakoff-Cayuga Mining Area. North Texas Archaeology Laboratory, Denton, Texas.

_____. 1978b. Archaeological Testing in the Malakoff-Cayuga Mining Area. North Texas Archaeology Laboratory, Denton, Texas.

Hershfield, D. M. 1961. Rainfall frequency atlas of the United States for durations from 30 mintues to 24 hours and return periods from 1 to 100 years. Technical Paper No. 40. Cooperative Studies Section, U. S. Weather Bureau, Washington, D. C.

Hindawi, I. J. 1970. Air pollution injury to vegetation. Nat. Air Pollution Control Administration Pub. No. AP-71. U.S. Gov. Printing Office, Washington, D.C.

Hons, F. M., et al. 1978. Physical and chemical properties of lignite spoil material as it influences successful revegetation. In: W. R. Kaiser (Ed.). Proceedings of the Gulf Coast Lignite Conference: Geology, Utilization and Environmental Aspects. Sponsored by Bureau of Economic Geology, University of Texas at Austin, Austin, Texas. p. 209-217.

Hosler, C. R. 1961. Low-level inversion frequency in the contiguous United States. Monthly Weather Review (89):319-339.

Houston Lighting & Power Company. 1980a. Water chemistry study of the site X project makeup water supply. Power Plant Civil Engineering Department. Houston, TX.

_____. 1980b. Site X water supply regional screening study. Power Plant Civil Engineering Department. Houston, TX.

_____. 1982a. Baseline survey of the aquatic ecology of the Malakoff Electric Generating Station and pipeline route. Environmental Protection Department, Houston, Texas.

_____. 1982b. Baseline survey of the aquatic ecology of the Trinity Lignite Mine Site. Environmental Protection Department, Houston, Texas.

_____. 1982c. Socioeconomic data memorandum.

Huffman, R. T. 1981. Multiple-parameter approach to the field identification and delineation of aquatic and wetland ecosystems, Report No. 1, Technical Standards. Technical Report EL-81. U. S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Jackson, E., L. Hartfield and S. Mitcham, Jr. 1978. Cultural resource assessment of the Oxbow Prospect, northwestern Louisiana. The Research Institute of Pure and Applied Science, Northeast Louisiana University.

Johnson, LeRoy, Jr. 1962. The Yarbrough and Miller Sites of Northeastern Texas, with a Preliminary Definition of the LaHarpe Aspect. Bulletin of the Texas Archaeological Society. Vol. 32:141-284. Austin.

Kaiser, W. W., W. B. Ayers and L. W. Labrie. 1980. Lignite resources in Texas. Report of investigations No. 104. Bureau of Economic Geology, University of Texas at Austin.

Kennedy, J. L. 1981. Hydrogeology of Reclaimed Gulf Coast Lignite Mines. Ph.D. Thesis, unpl. Texas A&M University.

King, J. 1981. Personal communication. Harris Realty, Malakoff, Texas.

Kologski, R. 1982. Personal communication. Endangered species specialist, U.S. Fish and Wildlife Service Region 2, Albuquerque, New Mexico.

Korshover, J. 1971. Climatology of stagnating anticyclones east of the Rocky Mountains, 1936-1970. U.S. Dept. of Commerce, NOAA Tech Memo. ERL ARL-34. Silver Spring, MD.

Lay, D. W. 1969. Quail management handbook for east Texas. Tex. Parks and Wildl. Dept., Bull. 34.

Linzon, S. N. 1978. Effects of airborne sulfur pollutants on plants. In: Sulfur in the Environment: Part II, Ecological Impacts. J. O. Nriagu (Ed.). Wiley, New York, pp. 109-106.

Lowery, G. H. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State Univ. Press, Baton Rouge.

Mathewson, C. C., K. W. Brown, L. E. Deuel and D. G. Kersey. 1982. The impact of surface lignite mining on surface- and ground-water quality in Texas. Texas A&M University, College Station, TX. 82 pp.

Mahler, W. F. 1979. Vegetation zones of Texas. *In:* *Rubus trivialis* Michx. var. *duplaris* (Shinners) Mahler, comb nov. (Rosaceae). *Sida* 8(2):212.

_____. 1980. Status report: *Sprianthes parksii* Correll. Unpublished report to FWS, March 31, 1980.

Marks, G. C. 1982. Personal communication. State Conservationist, USDA-SCS.

McIntyre, G. 1981. Personal communication. Henderson County Memorial Hospital, administrator.

McLure, L. and J. E. Howe. 1937. History of Shreveport and Shreveport builders. J. Ed Howe, publisher.

Mountain West Research, Inc. 1975. Construction worker profile.

National Academy of Sciences. 1977. Effects of nitrogen oxides on vegetation. *In:* Nitrogen Oxides. NAS, Washington, D.C., pp. 147-158.

National Council on Radiation Protection and Measurements (NCRP). 1975. Natural Background Radiation in the United States. NCRP Report No. 45 Washington, D. C.

National Research Council. 1977. Guidelines for preparing environmental impact statements on noise. Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences.

North American Coal Corporation. 1982a. Surface water input to the Trinity Mine EIS. Dallas, Texas.

_____. 1982b. Terrestrial ecology validation survey Malakoff-Cayuga Project Area. May 1982. Xerox. 10 p. w/map.

_____. 1982c. Socioeconomic questionnaire.

Pass, F. 1979. Texa state almanac and industrial guide.

Peckham, R. C., V. L. Souders, J. W. Dillard and B. B. Baker. 1973. Reconnaissance Investigation of the Ground-water Resources of the Trinity River Basin, Texas. Texas Water Commission. Bulletin 6309.

Pollock, C. R. 1982. Ground-water hydrogeology and geochemistry of a reclaimed lignite surface min. Unpublished Master of Science Thesis, Department of Geology, Texas A&M University, College Station, TX. 152 pp.

Potter, F.E. 1981. Status of the American Alligator in Texas. Texas Parks and Wildlife Report 7000-74, January 1981.

Radian Corporation. 1982. An air quality analysis for the Malakoff Electric Generating Station, Malakoff, Texas. DCN 82-142-793-02.

Railroad Commission of Texas. 1981. Coal Mining Regulations. Surface Mining and Reclamation Division, Austin, TX.

Richner, Jeffrey J. and Reed Lee. 1977. Archaeological and Ethnohistorical Survey at Tennessee Colony Lake, 1975. Southern Methodist University, Department of Anthropology Archaeology Research Program Research Report 104.

Richner, Jeffrey J. and Joe T. Bagot. 1978. A Reconnaissance Survey of the Trinity River Basin, 1976-1977. Southern Methodist University, Department of Anthropology Archaeology Research Program Research Report 113.

Riordan, P. J. 1979. Malakoff-Cayuga Lignite Field Report on Ground-water modeling Studies. Resource Analysis, Inc., unpl.

Schnieder, W. J. 1977. Analysis of the Densification of Reclaimed Surface Mined Land. M.S. Thesis. Texas A&M University.

Sellards, E. H. 1941. Stone Images from Henderson County, Texas. American Antiquity 7:29-38.

Shurtleff, M. C., M. B. Linn and J. B. Sinclair. 1972. Plant damage from air pollution. Univ. of Ill. Ext. Ser., Report on Plant Diseases No. 1005 (revised). Urbana.

Smith, R. M. and A. A. Sobek. 1979. Physical and chemical properties of overburdens, spoils, wastes, and new soils. In Reclamation of Drastically Disturbed Soils. American Society of Agronomy, Madison, Wisconsin.

Story, Dee Ann. 1965. The archeology of Cedar Creek Reservoir, Henderson and Kaufman Counties, Texas. Bulletin of the Texas Archeology Society 36.

Stutzenbaker, C. D. 1980. Waterfowl harvest recommendations. Fed. Aid Proj. No. W-106-R-7. Texas waterfowl program. Job Performance Report. Job No. I. Tex. Parks and Wildl. Dept., Austin.

Suhm, D. A., A. D. Kreiger and E. B. Jelks. 1954. An introductory handbook of Texas archeology. Bulletin of the Texas Archeological Society. Vol. 25. Austin.

Summerlin, G. 1981. Personal communication. Anderson County Memorial Hospital, administrator.

Texas Board of Insurance. 1981. Fire protection service inspections.

Texas Department of Health. 1978. Rules and Regulations for Public Water Systems. Austin, Texas.

_____. 1981. Municipal water system reports. Envir. Eng. Div.

Texas Department of Highways and Public Transportation. 1980. County traffic maps.

Texas Department of Water Resources. 1980. State permit subsystem short listing. Austin, TX.

_____. 1981a. Texas surface water quality standards. LP-171. Austin, TX.

_____. 1981b. Personal communication. Permit Control and Reports Section, Permits Division. Austin, TX.

_____. 1981c. Monthly effluent data reports, 1980-81.

Texas Natural Resources Information System. 1981. Water-oriented data bank. Precipitation, net evaporation, and flow duration data; statewide monitoring network sampling data inventory. Austin, TX.

Texas Water Development Board. 1965. Reconnaissance of the chemical quality of surface waters of the Neches River Basin, Texas. Report 5. Austin, TX.

_____. 1968. The Texas water plan. Austin, TX.

_____. 1973. Engineering data on dams and reservoirs in Texas, Report 126, Part II. Austin, TX.

_____. 1974. Engineering data on dams and reservoirs in Texas, Report 126, Part I. Austin, TX.

_____. 1977. Continuing water resources planning and development for Texas. Phase I. Vol. 2. Austin, TX.

Texas Water Quality Board. 1975. Water quality segment report for segment nos. 0804 and 0805, Trinity River. Report No. WQS-7. Austin, TX.

_____. 1976. Intensive surface water monitoring survey for segment 0818, Cedar Creek Reservoir. Report No. IMS 22. Austin, TX.

Thornton, L. 1982. Personal communication. Superintendent of Palestine Independent School District. Palestine, Texas.

Transportation Research Board. 1976. Highway noise generation and control. Report 173. National Cooperative Highway Research Program.

Trinity River Authority. 1974. Trinity River Basin water quality management plan, basic information.

Turner, Collie and Braden, Inc. 1980. Report on water supply study for project X. Houston, TX.

Urban Systems Research and Engineering. 1980. Induced impacts of new source industries: study and EIS preparation manual development.

Ursic, S. J. and F. E. Dendy. 1963. Sediment yields from small watersheds under various land uses and forest covers. In: Proceedings of the Federal Inter-agency Sedimentation Conference, USDA Misc. Publ. No. 970, Agricultural Research Service, Washington.

U.S. Army Corps of Engineers. 1978. Preliminary guide to wetlands of the Gulf Coastal Plain. Technical Report Y-78-5, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

_____. 1982. Personal communication. (Mr. Alan Brackeny with Mr. Charles Jasper.)

U. S. Department of Agriculture, Soil Conservation Service. 1965. Computer program for project formulation. Technical Release No. 20, Supplement No. 1. Washington, D. C.

_____. 1975. Soil survey of Anderson County, Texas. U. S. Government Printing Office, Washington, D. C.

_____. 1979. Soil Survey of Henderson County, Texas. U. S. Government Printing Office, Washington, D. C.

U. S. Department of Commerce, Bureau of the Census. 1962. Components of population change: 1950 to 1960. Curr. Pop. Rep., Series P-23, No. 7, November.

_____. 1967. Climatology of the United States. Climatological summaries of Texas No. 20-41.

_____. 1970a. Seismic Risk Map of the United States. NOAA Environmental Services Division. Publication 41-1.

_____. 1970b. Climatological summary. Waco, Texas.

_____. 1971a. Components of population change by county: 1960 to 1970. Curr. Pop. Rep., Series P-25, No. 461, June.

_____. 1971b. 1970 Census of population, Texas.

_____. 1975. STAR computer program output for Waco, Texas, 1969-1973. National Climatic Center. Asheville, NC.

_____. 1977. Local climatological data. Annual summary with comparative data, Waco, Texas.

_____. 1981a. Local climatological data, 1980, Athens, Texas.

_____. 1981b. 1980 Census of population and housing, Texas.

U. S. Department of Housing and Urban Development. 1980. Noise assessment guidelines. Office of Policy Development and Research.

U. S. Department of the Interior. 1980. Republication of lists of endangered and threatened species and correction of technical errors in final rules. Fed. Register 45(99):33767-33781.

U. S. Departments of the Army, Navy and Air Force. 1971. Dewatering and Groundwater Control for Deep Excavations. Technical Manual No. 5-818-5/NAVFAC P-418/AFM No. 88-5, Chapter 6. Washington, D. C.

U. S. Environmental Protection Agency. 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. Office of Noise Abatement and Control, Washington, D. C.

_____. 1977. Toward a national strategy for noise control. Office of Noise Abatement and Control, Washington, D. C.

———. 1978. Protective noise levels: condensed version of EPA levels document. Office of Noise Abatement and Control.

———. 1982. Environmental Impact Statement (DRAFT). Henry W. Pirkey power plant Unit-1/South Hallsville surface lignite mine project, Harrison County, Texas. EPA-906/9-82-004. Dallas, Texas.

U. S. Environmental Protection Agency and Applied Science Associates. 1976. Diagnosing Vegetation Injury Caused by Air Pollution, Chapters 3 and 4, Office of Air Quality Planning, Washington, D.C.

U. S. Geological Survey. 1979. Water resources data for Texas-water year 1978. USGS Water-Data Report TX-78-1. U. S. Government Printing Office, Washington, D. C.

———. 1980a. Water resources data for Texas-water year 1979. USGS Water-Data Report TX-79-1. U. S. Government Printing Office, Washington, D. C.

———. 1980b. Streamflow statistical package. National Water Data Storage and Retrieval System (WATSTORE). Reston, VA.

———. 1981. Water resources data for Texas-water year 1980. USGS Water-Data Report TX-80-1. U. S. Government Printing Office, Washington, D. C.

Veteto, G. H. 1978. Personal communication and unpublished data. Gus Engeling Wildlife Management Area. Tex. Parks and Wildl. Dept., Tennessee Colony.

Von Hake, C. A. 1977. Earthquake History of Texas. USGS Earthquake Information Bulletin. Vol. 9, No. 3.

Wardell, T. 1982. Personal communication. Superintendent of Corsicana Independent School District. Corsicana, Texas.

Willey, Gordon R. 1966. An introduction to American Archaeology. Prentice Hall, Inc.

Woolsey, A. M. 1935. Notes on Fieldwork, Jasper Tucker (Negro) Farm, Mrs. Joe Watkins (Negress), Owner, 9 Miles Southwest of Frankston, Anderson County. University of Texas at Austin, on file at Texas Archeological Research Laboratory, Austin, Texas.

9.0 GLOSSARY

ACCESS ROAD

Any haul road or other road constructed, improved, maintained or used by the operator which ends at the pit or bench, and is located within the area of land affected.

ACID DRAINAGE

Water with a pH of less than 6.0 and in which total acidity exceeds total alkalinity, discharged from an active, inactive or abandoned surface coal mine and reclamation operation or from an area affected by surface coal mining and reclamation operations.

ACID-FORMING MATERIALS

Earth materials that contain sulfide minerals or other materials which, if exposed to air, water or weathering processes, form acids that may create acid drainage.

ACID SOIL

Generally, a soil that is acid throughout most or all of the parts of it that plant roots occupy. Commonly applied to only the surface-plowed layer or to some other specific layer or horizon of a soil. Practically, this means a soil more acid than pH 6.6; precisely, a soil with a pH value less than 7.0. A soil having a preponderance of hydrogen over hydroxyl ions in the soil solution.

ACID SPOIL

Usually spoil material containing sufficient pyrite so that weathering produces acid water and the pH of the soil determined by standard methods of soil analysis is between 4.0 and 6.9.

ACRE-FOOT

A term used in measuring the volume of water, equal to the quantity required to cover 1 acre 1 ft in depth, of 43,560 cu ft.

ADJACENT AREA

Land located outside the affected area, permit area or mine plan area, depending on the context in which adjacent area is used, where air, surface or ground water, fish, wildlife, vegetation or other resources may be adversely impacted by surface coal mining and reclamation operations.

AFFECTED AREA

With respect to surface mining activities, any land or water upon or in which those activities are conducted or located.

AGRICULTURAL USE

The use of any tract of land for the production of animal or vegetable life. The uses include, but are not limited to, the pasturing, grazing and watering of livestock, and the cropping, cultivation and harvesting of plants.

AIR POLLUTION

The action of making air physically impure or unclear; contaminating air with man-made waste.

AIR QUALITY, AMBIENT

Condition or quality of the surrounding air.

ALKALINE SOIL

Generally, a soil that is alkaline throughout most or all of the parts of it occupied by plant roots; although the term is commonly applied to only a specific layer or horizon of a soil. Precisely, any soil horizon having a pH value greater than 7.0. Practically, a soil having a pH above 7.3.

APPROXIMATE ORIGINAL CONTOUR

Surface configuration achieved by backfilling and grading of the mined areas so that the reclaimed area, including any terracing or access roads, closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain, with all highwalls, spoil piles and coal refuse piles eliminated.

AQUIFER

1. A water bearing formation through which water moves more readily than in adjacent formations with lower permeability.
2. A zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use.

AREA STRIP MINING

Surface mining which is not narrowly confined by topographic or overburden depth characteristics and which typically covers relatively large tracts on gently rolling to relatively flat terrain. Mineral is removed by digging a series of parallel trenches with spoil material being placed in the cut made during the previous pass.

BACKFILL

The operation of refilling an excavation. Also the material placed in an excavation in the process of backfilling.

BENCH

The surface of an excavated area at some point between the material being mined and the original surface of the ground on which equipment can set, move or operate. A working road or base below a highwall as in contour stripping for coal.

BOX CUT

The initial cut driven in a property, where no open side exists; this results in a highwall on both sides of the cut.

BUCKET WHEEL EXCAVATOR

A continuous digging machine composed of a boom on which is mounted a rotating vertical wheel having buckets on its periphery. As the rotating wheel is pressed into the material to be excavated, the buckets scoop material and discharge it onto a conveyor belt system for transport to loading or dump sites.

BUFFER STRIPS

1. Unaffected areas between the mining operation and areas designated for other public and private use.
2. Strips of grass or other erosion-resisting vegetation between or below surface or auger mining disturbances.

CONCENTRATION (water quality usage)

The amount of a substance occurring in a given amount of water - common unit is parts per million (ppm) or milligrams per liter (mg/l).

CRITICAL HABITAT

See HABITAT, CRITICAL.

CUMULATIVE IMPACT

See IMPACT, CUMULATIVE.

DISCHARGE (flow)

The quantity of water moving past a specific point in a stream. Measured by a specific flow-measuring device.

DISSOLVED OXYGEN

The extent to which oxygen occurs in solution in water or wastewater; usually expressed as concentration, in parts per milion, or percent of saturation.

DISSOLVED SOLIDS

The difference between the total and suspended solids in water.

DISTURBED AREA

An area where vegetation, topsoil or overburden is removed or upon which topsoil, spoil, coal processing waste, underground development waste or noncoal waste is placed by surface coal mining operations. Those areas are classified as disturbed until reclamation is complete and the performance bond or other assurance of performance is released.

DIVERSION

1. Channel constructed across the slope for the purpose of intercepting surface runoff. Changing the accustomed course of all or part of a stream. Also, a ditch or canal by which water is diverted from one stream to another.
2. A channel, embankment or other man-made structure constructed to divert water from one area to another.

DRAGLINE

An excavating machine that utilizes a bucket operated and suspended by means of lines or cables, one of which hoists or lowers the bucket from a boom; the other, from which the name is derived, allows the bucket to swing out from the machine or to be dragged toward the machine for loading. Mobility of draglines is by crawler mounting or by a walking device for propelling, featuring pontoon-like feet and a circular base or tub. The swing of the machine is based on rollers and rail. The machine usually operates from the highwall.

DRAINAGE BASIN

The area from which water is carried off by a drainage system, a watershed or a catchment area.

EMISSION

A discharge of pollutants into the environment, generally used in regard to releases into the atmosphere.

ENVIRONMENT

All external conditions that may act upon an organism or soil to influence its life, development and ultimately the organism's survival; including sunlight, temperature, moisture and other organisms.

ENVIRONMENTAL IMPACT ASSESSMENT

An evaluation and objective prediction of the environmental impacts of a proposed action using a systematic, interdisciplinary approach that integrates social and natural sciences and environmental design arts.

ENVIRONMENTAL IMPACT STATEMENT (EIS; Environmental Statement; 102 Statement)

A document prepared by a Federal agency in which anticipated environmental effects of a planned federal course of action or development are evaluated. A Federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form, and then, in a final form. An impact statement includes the following points:

1. the environmental impact of the proposed action,
2. any adverse impacts that cannot be avoided by the action,
3. the alternative courses of action,
4. the relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
5. a description of the irreversible and irretrievable commitment of resources that would occur if the action were accomplished.

ENVIRONMENTAL IMPACT STATEMENT, DRAFT (DEIS; Draft Environmental Statement; DES)

The version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document which must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) Guidelines, and directives of the agency responsible for the project proposal. Since the adoption of state and local laws modeled after NEPA, this term has also been used to refer to similar statements required to comply with those laws. See ENVIRONMENTAL IMPACT STATEMENT; ENVIRONMENTAL IMPACT STATEMENT, FINAL.

ENVIRONMENTAL IMPACT STATEMENT, FINAL (FEIS; Final Environmental Statement; FES)

The final version of the statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA). It is a revision of the draft environmental impact statement to include public and agency responses to the draft. It is a formal document that must meet legal requirements and is the document used as a basis for judicial decisions concerning compliance with NEPA. This term is also used for similar statements prepared to comply with state and local laws patterned after NEPA. See ENVIRONMENTAL IMPACT STATEMENT; ENVIRONMENTAL IMPACT STATEMENT, DRAFT.

EROSION

The wearing away of the land surface by running water, wind, ice or other geological agents, including such processes as gravitational creep. Detachment and movement of soil or rock fragments by water, wind or ice, or gravity.

FLOOD, 10-YEAR

The flow of a stream which has been equaled or exceeded, on the average once in 10 years (or other designated period).

FUGITIVE DUST

That particulate matter not emitted from a duct or stack which becomes airborne due to the forces of wind or surface coal mining and reclamation operations or both.

During surface coal mining and reclamation operations it may include emissions from haul roads; wind erosion of exposed surfaces, storage piles and spoil piles; reclamation operations; and other activities in which material is either removed, stored, transported or redistributed.

GROUND WATER
Subsurface water occupying the saturation zone, from which wells and springs are fed. In a strick sense the term applies only to water below the water table. Also called plerotic water; phreatic water.

HABITAT, CRITICAL
Any air, land or water area, including any elements thereof, that the Secretary of the Interior, through the Director, U. S. Fish and Wildlife Service or National Marine Fishery Service, has determined is essential to the survival of wild populations of a listed species or to its recovery to a point at which the measures provided pursuant to the Endangered Species Act of 1973 are no longer necessary. Such determinations are published in the Federal Register.

HAUL ROAD
Road from pit to loading dock, tipple, ramp or preparation plant used for transporting mined material by truck.

HEAVY METALS
Metallic elements of high molecular weight, generally toxic to plant and animal life in low concentrations. Such metals are often residual in the environment and exhibit biological accumulation. Examples include mercury, chromium, cadmium, arsenic and lead.

HISTORIC LANDS
Historic or cultural districts, places, structures or objects, including archeological and paleontological sites, National Historic Landmark sites, sites listed on or eligible for listing on a State or National Register of Historic Places, sites having religious or cultural significance to native Americans or religious groups or sites for which historic designation is pending.

HISTORICALLY USED FOR CROPLAND
(1) Lands that have been used for cropland for any five years or more out of the 10 years immediately preceding the acquisition, including purchase, lease or option of the land for the purpose of conducting or allowing through resale, lease or option the conduct of surface coal mining and reclamation operations; (2) lands that the regulatory authority determines, on the basis of additional cropland history of the surrounding lands and the lands under consideration, that the permit area is clearly cropland but falls outside the specific 5-years-in-10 criterion, in which case the regulations for prime farmland may be applied to include more years of cropland history only to increase the prime farmland acreage to be preserved; or (3) lands that would likely have been used as cropland for any 5 out of the last 10 years, immediately preceding such acquisition but for the same fact of ownership or control of the land unrelated to the productivity of the land.

HYDROLOGY
The science that relates to the water systems of the earth.

IMPACT
An observed effect that occurs in the environment as the result of some disturbance.

IMPACT, CUMULATIVE

The sum of a variety of environmental changes and their total effect resulting from several facilities (i.e., energy-development projects) over time.

IMPACT, DIRECT (Primary Impact)

Direct or primary impacts are those in which the causative agent impinges directly upon the responding ecological components, e.g., land clearing for construction causes direct loss of vegetation.

IMPACT, INDIRECT (Secondary or Tertiary Impact)

Indirect or secondary effects are those in which man-caused change in the environment creates one or more intermediary effects in a chain of events leading to the observation of the impact.

IMPACT, LONG-TERM AND SHORT-TERM

These terms refer to the relative duration of an impact. No strict definition of the relative time frames involved in short- and long-term impacts exists, so a time frame should be specified whenever either word is used. Generally, long-term impacts are those lasting for the duration of the project or longer. Short-term impacts are generally those lasting only during the construction phase or occuring for brief periods during the operation of the facility.

IMPACT, SIGNIFICANT

Any impact resulting in measurable changes in indicator parameters or community dynamics (such as reduced primary production).

INFILTRATION

Water entering the ground water system through the land surface.

LAND USE

Specific uses or management-related activities, rather than the vegetation or cover of the land. Land uses may be identified in combination when joint or seasonal uses occur.

a. Cropland means land used for the production of adapted crops for harvest, alone or in a rotation with grasses and legumes, and includes row crops, small grain crops, hay crops, nursery crops, orchard crops, and other similar specialty crops. Land used for facilities in support of cropland farming operations which is adjacent to or an integral part of these operations is also included for purposes of these land use categories.

b. Pastureland or land occasionally cut for hay. Land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed. Land used for facilities in support of pastureland or land occasionally cut for hay which is adjacent to or an integral part of these operations is also included.

c. Grazingland. Includes both grasslands and forest lands where the indigenous vegetation is actively managed for grazing, browsing or occasional hay production. Land used for facilities in support of ranching operations which are adjacent to or an integral part of these operations is also included.

d. Forestry. Land used or managed for the long-term production of wood, wood fiber, or wood derived products. Land used for facilities in support of forest harvest and management operations which is adjacent to or an integral part of these operations is also included.

e. Residential. Includes single- and multiple-family housing, mobile home parks, and other residential lodgings. Land used for facilities in support of residential operations which is adjacent to or an integral part of these operations is also included. Support facilities include, but are not limited to, vehicle parking and open space that directly relate to the residential use.

f. Industrial/Commercial. Land used for:

1. Extraction or transformation of materials for fabrication of products, wholesaling of products for long-term storage of products. This includes all heavy and light manufacturing facilities such as lumber and wood processing, chemical manufacturing, petroleum refining, and fabricated metal products manufacture. Land used for facilities in support of these operations which is adjacent to or an integral part of that operation is also included. Support facilities include, but are not limited to, all rail, road and other transportation facilities.
2. Retail or trade of goods or services, including hotels, motels, stores, restaurants and other commercial establishments. Land used for facilities in support of commercial operations which is adjacent to or an integral part of these operations is also included. Support facilities include, but are not limited to, parking, storage or shipping facilities.

g. Recreation. Land used for public or private leisure-time use, including developed recreation facilities such as parks, camps and amusement areas, as well as areas for less intensive uses such as hiking, canoeing and other undeveloped recreational uses.

h. Fish and Wildlife Habitat. Land dedicated wholly or partially to the production, protection or management of species of fish or wildlife.

i. Developed Water Resources. Includes land used for storing water for beneficial uses such as stockponds, irrigation, fire protection, flood control and water supply.

j. Undeveloped Land or No Current Use or Land Management. Land that is undeveloped or, if previously developed, land that has been allowed to return naturally to an undeveloped state or has been allowed to return to forest through natural succession.

LAND USE, REGIONAL

a. Cropland. Land in tillage rotation, orchards and land formerly used for crops which has not been purposely converted to another use. Lands used for hay meadows are included in cropland.

b. Pasture. Lands producing forage plants, principally introduced species for animal consumption. In addition to regulating the intensity of grazing, management practices would usually include one or more cultural recurring treatments such as reseeding, renovation, reestablishment, mowing, liming or fertilization. Pasture lands may also be unimproved natural grasslands used for forage.

c. Range. Lands in which the natural potential (climax) plant cover is composed principally of native grasses, forbs and shrubs. Other than brush control, management is primarily achieved by regulating the intensity of grazing and seasonal use.

d. Forest Land. Lands which (a) are at least 10 percent stocked by forest trees of any size and capable of producing timber or other wood products, or capable of exerting an influence on the water regime; (b) lands from which the trees described in (a) have been removed to less than 10 percent stocking and which have not been developed for other uses; (c) afforested (planted) areas; and (d) chaparral areas may be commercial, non-commercial or forest land grazed.

e. Urban or Built-up Areas. Areas that include cities, villages and built-up areas of more than 4.04 ha (10 ac). Also includes road and railroad acres, industrial sites, railroad yards, cemeteries, airports, golf courses, institutional and public administrative sites.

f. Water Areas. Includes ponds and lakes of more than .81 ha (2 ac). Also includes rivers and streams that are less than one-eighth mile wide.

g. Other Land. Non-Federal land not classified as cropland, pasture and range, forest woodland or urban and built-up.

LEACHING

Extraction of dissolved or suspended materials from a solid by a liquid.

Mg/l

Abbreviation for milligrams per liter, which is a weight to volume ratio commonly used in water quality analysis. It expresses the weight in milligrams of a substance occurring in one liter of liquid.

MACROPHYTE

A general term referring to aquatic plants (both rooted and free-floating) which can be identified without the aid of a microscope.

METRIC, CONVERSION TO

(See Table G-1, pg. 9-12.)

MINE DRAINAGE

Any water forming on or discharging from a mining operation, including runoff and seepage. May be alkaline or acid in nature.

MINE-MOUTH PLANT

A steam-electric plant or coal gasification plant built close to a coal mine; usually associated with delivery of output via transmission lines or pipelines over long distances, as contrasted with plants located nearer load centers and at some distance from sources of fuel supply.

MITIGATION

1. Avoiding the impact altogether by not taking a certain action or parts of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact by repairing, rehabilitating or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

NONPOINT SOURCE

Any nonconfined area from which pollutants are discharged into a body of water, i.e., agricultural runoff, urban runoff and sedimentation from construction sites.

OVERBURDEN

1. Soil, rock and other materials which overlie mineral deposits and are removed in surface mining.
2. Material of any nature, consolidated or unconsolidated, that overlies a coal deposit, excluding topsoil.

pH

The symbol or term refers to a scale commonly used to express the degrees of acidity or alkalinity. On this scale of pH of 1 is the strongest acid, pH of 14 is the strongest alkali, pH of 7 is the point of neutrality at which there is neither acidity or alkalinity. pH is not a measure of the weight of acid or alkali contained in or available in a given volume.

PIT

Used in reference to a specifically describable area of open cut mining. May be used to refer to only that part of the open cut mining area from which coal is being actively removed or may refer to the entire contiguous mined area.

POLLUTANT

Any contaminant that, when present in the air or water, detracts from or interferes with the desired use or natural state of that air or water.

PRIME FARMLAND

Those lands which are defined by the Secretary of Agriculture in 7 CFR 657 (Federal Register Vol. 4, No. 21).

PYRITE

A yellowish mineral, iron disulfide, FeS_2, generally metallic appearing; also known as "fool's gold."

RECLAMATION (Rehabilitation)

1. The process of reconverting mined or other disturbed land to its former or other productive uses.
2. The process of making a site habitable to organisms that were originally present or others that approximate the original inhabitants.
3. Those actions taken to restore mined land to a postmining land use approved by the regulatory authority.

REVEGETATION

Re-establishment and maintenance of growth or plants to replace original ground cover following land disturbance.

RUNOFF

That portion of the rainfall that is not absorbed by the deep strata; is utilized by vegetation or lost by evaporation or may find its way into streams as surface flow.

SEDIMENT

Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.

SEDIMENTATION POND

A primary sediment control structure including but not limited to a barrier, dam or excavated depression which slows down water runoff to allow sediment to settle out.

SPECIES

Rare -	A species not commonly found in a given area due to its habitat requirements, small population size, or discrete distributional patterns, etc.
Threatened -	A species whose future existence is jeopardized in the foreseeable future because its habitat is threatened with destruction, drastic modification or severe curtailment, or for other reasons such as over-exploitation, disease, pollution, predation, etc.
Endangered -	A species whose continued existence is in immediate peril because of critically low or declining populations.
Unique -	A species only found in a particular area, region or habitat type.
Game -	Any animal harvested or taken for food or sport.

SPOIL

1. The overburden or non-coal material removed in gaining access to the coal or mineral material in surface mining.
2. Overburden that has been removed during surface coal mining operations.

STRIP MINE

Refers to a procedure of mining which entails the complete removal of all material from over the product to be mined in a series of rows or strips; also referred to as "open cut," "open pit" or "surface mine."

SURFACE MINING

Mining method whereby the overlying materials are removed to expose the mineral for extraction.

SUSPENDED SOLIDS

Sediment which is in suspension in water but which will physically settle out under quiescent conditions (as differentiated from dissolved material).

THIXOTROPIC

A material which appears and acts as a solid when undisturbed but will change to a semi-liquid when agitated.

TOPSOIL

Presumed fertile soil material -- used as a top dressing. Distinction has been made among synthetic, weathered and geologic topsoil. Synthetic topsoil can include sand and stone chips as well as fly ash, sawdust or manure not usually a part of geological soil and rock. Weathered topsoil is the natural top-dressing material that has been subjected to weathering throughout geologic time.

WATER QUALITY

A term used to describe the chemical, physical and biological characteristics of water in respect to its suitability for a particular use.

WATER TABLE

1. The upper surface of the ground water or that depth below which the soil is saturated with water. It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water. In wells that penetrate to greater depths, the water level will stand above or below the water table if an upward or downward component of ground-water flow exists.
2. The upper surface of a zone of saturation, where the body of ground water is not confined by an overlying impermeable zone.

TABLE G-1
METRIC CONVERSION FACTORS
(International System of Units)

Quantity	Symbol	English	Multiply by	Metric	Symbol
Length					
	in	inches	2.54	centimeters	cm
	ft	feet	30.48	centimeters	cm
	yd	yard	0.91	meters	m
	mi	miles	1.61	kilometers	km
Area					
	in^2	square inches	6.45	square centimeters	cm^2
	ft^2	square feet	0.09	square meters	m^2
	yd^2	square yards	0.84	square meters	m^2
	mi^2	square miles	2.59	square kilometers	km^2
	ac	acre	0.41	hectares	ha
Mass (weight)					
	oz	ounces (avdp)	28,350.00	milligrams	mg
	oz	ounces (avdp)	28.35	grams	g
	lb	pounds	0.45	kilograms	kg
	tons	short tons (2,000 lbs)	0.91	tons (metric)	tons
Temperature					
	°F	Fahrenheit degrees	5/9 (after subtracting 32)	Celsius degrees	°C
Pressure					
	psi	pounds per square inch	703.07	kilograms per square meter	kg/m^2
Volume					
	fl oz	fluid ounces	29.573	milliliters	ml
	qt	quarts	0.946	liters	liters
	gal	gallons	3.785	liters	liters
	ft^3	cubic feet	0.028	cubic meters	m^3
	yd^3	cubic yards	0.765	cubic meters	m^3
	bbl	barrels (oil)	0.159	cubic meters	m^3
	ac-ft	acre-feet	1,233.487	cubic meters	m^3
Speed (velocity)					
	ft/s	feet per second	0.3048	meters per second	m/s
	ft/s	feet per second	0.0003	kilometers per second	km/s
	ft/min	feet per minute	0.5080	centimeters per	cm/s
	mi/hr	miles per hour	0.4470	meters per second	m/s
	mi/hr	miles per hour	1.6093	kilometers per hour	km/hr
	mi/hr	miles per hour	0.8684	knots	kts
Energy					
	Btu	British thermal units	0.0002928	kilowatt hours	KWh
	hp	horse power	0.74570	kilowatts	kw
Flow Rate					
	gal/min	gallons per minute	0.0630907	liters per second	liters/sec
	gal/d	gallons per day	0.0037854	kiloliters per day	kl/da
	tpy	tons per year	0.9071850	metric tons per year	tpy
	cfs	cubic feet per second	0.0283170	cubic meters per second	m^3/s

Appendix A

Section 404(b)(1) Evaluation
(prepared under the guidelines of 24 December 1980 (40 CFR 230))
of the Proposed Malakoff Electric Generating Station
and Trinity Mine

Appendix A

Section 404(b)(1) Evaluation
(prepared under the guidelines of 24 December 1980 (40 CFR 230)) of the Proposed Malakoff Electric Generating Station and Trinity Mine

I. Project Description

a. Location. The Malakoff Electric Generating Station would be located about three miles south-southwest of the City of Malakoff, in Henderson County Texas. The project would include a makeup water system which would result in the discharge of dredge material during construction of the intake structure, to be located on the Neches River approximately 24 river miles below Lake Palestine, and during construction of the makeup water pipeline at several stream crossings between the intake structure and the power station site. An extremely small area (9 ac) of wetlands would be impacted due to construction of two 345 kV transmission facilities associated with the generating station. Additionally, the project would include the discharge of fill material for a service road parallel to the lignite conveyor between the generating station and the Trinity Mine. A more detailed description of the generating station and ancillary facilities is presented in EIS Sec. 4.5.1.

The Trinity Mine is to be located in Henderson and Anderson counties, Texas. The mine site is bounded on the west by Cedar Creek and the Trinity River, on the east by Farm-to-Market Road 59, on the north by the St. Louis-Southwestern Railroad and on the south by a line parallel and just south of U. S. Highway 287. During mining operations, during construction of the access road and certain haulroads, and during the relocation of existing pipelines and transmission facilities, the discharge of fill material would occur. A more detailed description of the mine and ancillary facilities is presented in EIS Sec. 4.5.2.

b. General Description. The work subject to evaluation under Section 404 is the excavation and placement of fill material below the plane of the ordinary high water mark of the Neches River (at the location of the intake structure) and the excavation and placement of fill in wetland areas associated with intermittent and ephemeral streams along the pipeline corridor. In addition, a small amount of excavation and placement of fill would occur at the base of the self supporting latice steel towers for the transmission facilities. Along the lignite conveyor excavation and placement of fill material would occur as a result of construction of the conveyor itself and the service road which would be constructed immediately adjacent to the conveyor.

Within the Trinity Mine, fill material would be placed for the construction of the mine access road, excavation and placement of fill would occur during the relocation of existing transmission lines and pipelines around the areas to be mined. In addition, during mining operations, excavation and placement of fill material would occur as a result of stream relocations, haulroad construction and mining activities.

c. Authority and Purpose. Houston Lighting & Power Company proposes to construct and operate the generating station under authority granted by the Public Utilities Commission of Texas to provide a dependable supply of electricity for municipal, industrial and residential customers within its service area. The North American Coal Corporation and Getty Oil Company propose to construct and operate the Trinity Mine under authority granted by the Railroad Commission of Texas (Surface Mining Division) to provide a dependable supply of fuel for the Malakoff Electric Generating Station.

d. General Description of Dredged or Fill Material. Borrow sources for construction of the service road along the lignite conveyor, the access road for the mine, stream reroutes and various haulroads would be located generally within the area immediately adjacent to the proposed structures. Exact locations and size of borrow areas for the structures would have to be adjusted as construction progresses and more detailed investigations on quantity and quality of materials became available. The material would consist primarily of the alluvial flood plain sediments of the Trinity River.

In all other instances, material would first be removed and then replaced, including construction of the transmission facilities, intake structure conduit and makeup water pipeline, the relocation of pipelines and transmission facilities, and during actual mining operations.

e. Description of the Proposed Discharge Site. The proposed location of all project related facilities with the exception of the intake structure and makeup water pipeline is shown in Fig. 4-12 in the EIS. The proposed location of the makeup water pipeline is shown in Fig. 4-4 of the EIS. The location of the intake structure would be at the eastern-most terminus of the makeup water pipeline. Construction of the generating station, makeup water system and mine would begin in 1983. Construction of the makeup water system is estimated to take approximately two years. The construction period for the generating station is estimated to be approximately six years. The estimated operating life of the mine is 35 years.

The rate of construction and the actual timing of the movement and discharge of material would depend on development of final design, plans and specifications, contract advertisement and award, and weather conditions.

f. Description of Disposal Method. The excavation and placement of fill would be accomplished using conventional heavy equipment (bulldozers, draglines, hauling and compaction equipment, front-end loaders, scrapers and backhoes) typically used for excavation, road construction and mining operations.

II. Factual Determinations

a. Physical Substrate Determinations. The substrate in the project area is a mixture of sands, silts and clays, with deposits of gravel in the Trinity River alluvium. Construction of the shoreline intake structure would have little or no effect on the flow of water or sediments in the Neches River. Likewise, burying of the pipeline across several intermittent and ephemeral streams should not effect the flow of water or sediments during periods of flow.

The mine access road and all mine haulroads would be constructed in accordance with applicable Railroad Commission of Texas regulations (Railroad Commission, 1981). At a minimum, these regulations require that natural channel drainage is not blocked and that no significant damage occurs to the hydrologic balance. The conveyor service road would be constructed in such a manner as to ensure the flow of water would not be significantly reduced. Stream diversions and reroutes would be in accordance with the Texas Coal Mining Regulations, Sections 341 and 342 (Railroad Commission of Texas, 1981) which specify requirements for protection of the hydrologic balance with regard to diversions and conveyance of overland flow and shallow ground-water flow, and ephemeral streams.

All active mine areas and construction areas would use erosion control measures, including but not limited to, sedimentation ponds, hay bale barriers and establishment of temporary vegetative cover in all disturbed areas. The use of sedimentation ponds would be expected to reduce peak flows and sedimentation of downstream aquatic and wetland habitats. These mitigative measures are required by Railroad Commission of Texas (1982) to reduce impacts to aquatic and wetland habitats. The wetland areas in the mining areas would be destroyed. None of the wetlands areas affected by mining activities are unique biological or ecological systems, as these same types occur throughout the Trinity River basin, as well as along other major rivers in Texas and throughout the southeastern United States. Their loss, however, would represent an incremental reduction of the total amount of wetlands remaining in the Trinity River basin. Wetlands areas in the Trinity basin and other major basins have been and are being reduced due to inundation by reservoirs, clearing and draining for agricultural use and mineral recovery. The wet bottomland hardwood forests and other hydric and aquatic habitats within the area to be disturbed by mining activities provide prime habitat for a number of wildlife species.

b. Water Circulation, Fluctuation and Salinity Determinations. Sedimentation from construction areas and disturbed areas within the mine would be trapped by sedimentation ponds. These sedimentation ponds would alter the timing, duration and frequency of peak discharges. Reduction of peak discharges by sedimentation ponds would result in a reduction of stream flushing but would also extend the period of flow in intermittent and ephemeral streams. No discernable flow differences in the Trinity River (the ultimate receiving water for all surface-water drainage) would result either during mining or after mining as a result of mining operations. Therefore, no effect on the salinity of Trinity Bay and associated estuarine areas would occur.

c. Suspended Particulate/Turbidity Determinations. Construction at the location of the intake structure on the Neches River, and at stream crossings traversed by the makeup water pipeline, as well as construction of the generating station and mine facilities on site would result in increased erosion and the potential for sedimentation. Where practicable, sedimentation control structures (hay bale barriers, sedimentation ponds, berms and ditches) would be employed to reduce the amount of sedimentation occurring. No industrial sites or disposal areas are known to occur in any areas of disturbance related to project structures, therefore, the sedimentation which would occur would be native materials that do not contain organic or inorganic constituents at levels exceeding those currently entering downstream wetlands and water bodies. Fill used would be composed mostly of naturally occurring sand, silts and clays.

Storm runoff and high flows during construction and mining activities would temporarily cause high levels of dissolved and suspended solids. Turbidity increases would occur during construction of the intake structure, pipeline, bridge and culvert placement for the access and haulroads as well as stream reroutes occurring during mine operations. As streams in the project area are naturally highly turbid, no significant decrease in light penetration or photosynthetic activity in Cedar Creek or the Trinity River would be expected.

d. Contaminant Determination. Since the fill material would consist predominately of native sands, silts and clays and because none of the material to be excavated and returned during construction and mining operations is considered to contain unacceptable concentrations of contaminating constituents, no significant contamination would be expected. As previously discussed, sedimentation ponds' pH adjustment, if required, would further reduce the concentration of trace elements in a soluble form.

e. Aquatic Ecosystem and Organism Determination. Physical habitat modification would be expected to result in a localized short-term, adverse impact to aquatic organisms in the area adjacent to the construction site of the intake structure on the Neches River. The area to be occupied by the structure itself would result in the long-term loss of a minor amount of aquatic habitat. EPA has determined that the intake structure would be in compliance with the Best Technology Available for the Location, Design, Construction and Capacity of Cooling Water Intake Structures for Minimizing Adverse Environmental Impact.

The makeup water pipeline would cross White Oak, Cooper, Walnut, Little Brushy, Brushy, Wolf, Catfish, Mine, Mill, Turkey and Walnut creeks. In most instances, stream crossings by the pipeline would occur within the upper reaches of the streams. The excavation and fill of native materials would locally affect benthic populations in the direct construction zone and those immediately downstream due to sedimentation, assuming water flow would be present during construction. The populations would be expected to quickly recolonize following cessation of construction activities since substrate would be similar to preconstruction conditions.

No construction related impacts to aquatic biota are anticipated due to construction of the transmission facilities as the area to be affected is comprised of native pasture and bottomland forest. The small amount of aquatic habitat would be largely avoided during construction.

The construction of the mine access road, lignite conveyor and associated service road, and the relocation of existing pipelines and transmission lines would affect a segment of Walnut Creek and associated wetlands. Culverts and/or a bridge would be built at the actual stream crossing. Excavation and placement of native fill material would cause some downstream sedimentation which would be trapped by the downstream impoundment, prior to entry into Cedar Creek. No significant impact to aquatic biota would be anticipated.

Mining activities would result in the excavation and replacement of native materials in exiting impoundments and wetland areas within the active mine area. It is anticipated that these habitats would be lost as a result of mining operations, except that the two SCS floodwater retarding structures would be replaced and many of the sedimentation ponds would be incorporated into postmining land use as aquatic environments. Therefore, some mitigation to aquatic habitats removed would result.

Stream reroutes would necessarily result in the destruction of aquatic habitat, however, the rerouted channels would be restored to approximate longitudinal profile and cross section and new channels are expected to rapidly recolonize.

f. Proposed Disposal Site Determinations. The quantity of contaminated materials in Neches River sediments at the site of the intake structure would be expected to be extremely small. Construction contracts should be written to include consideration and control of water pollution to the extent practicable. An existing water supply intake is located immediately downstream of the proposed construction site. However, because of the low velocity of the water in this segment of the river, due to the low water dam, sediments should settle rapidly except under conditions of peak flows due to storm water runoff, in which case sediment loads would be naturally high due to upstream erosion.

General water quality standards for this segment of the Neches River (#604) are included in the Texas Water Quality Standards. Except for increases in turbidity, construction of the intake structure should not cause significant degradation of water quality downstream.

The material excavated and replaced during construction of the makeup pipeline at stream crossings would contribute to downsteam sedimentation assuming flow was occurring at the time of excavation and fill. Since the materials excavated would be native soils, with the exception of increased turbidity, no significant degradation of water quality would be anticipated.

Increases in suspended solids would be expected in the runoff areas in which vegetation clearing, road building and construction activities take place. This potential impact would be controlled by diverting runoff around disturbed areas and by the use of sediment filters and sediment ponds for runoff from disturbed areas. Similarly, during mining operations, the potential would exist for increases in total suspended solids. Impacts would be minimized by the use of the above sedimentation control features. The materials to be excavated in the active mining areas would be replaced near their original location.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. Cumulative effects on the aquatic ecosystem are discussed in Sec. 5.8.3 of the EIS.

h. Determination of Secondary Effects on the Aquatic Ecosystem. Secondary effects of the proposed discharge are discussed in Sec. 5.8.3 of the EIS.

i. Evaluation and Testing of Dredged or Fill Material. Native soils and parent geologic materials represent the primary source of dredged and/or fill material. It would be substantially the same in composition and contaminant levels as the substrate on which it would be discharged. The use of this material in project construction and operation should not significantly alter contaminant levels at any of the discharge sites. 40 CFR 230.60(c) states that "Where the discharge site is adjacent to the extraction site and subject to the same sources of contaminants, and materials at the two sites are substantially similar, the fact that the material to be discharged may be a carrier of contaminants is not likely to result in degradation of the disposal site. In such circumstances, when dissolved material and suspended particulates can be controlled to prevent carrying pollutants to less contaminated areas, testing will not be required." All discharge sites discussed previously would be expected to meet these requirements. Measures to ensure the stability of project fills would include compaction, revegetation, proper slope design and the use of concrete or riprap stabilization as required.

III. Findings of Compliance for the Malakoff EGS/Trinity Mine Project

a. Adaption of the Section 404(b)(1) Guidelines to this Evaluation. No significant adaptions of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. No practicable alternatives for the proposed discharge site (return of excavated material to near its original position) are known. This is especially true in the case of mining operations, where the Texas Surface Mining Regulations call for return of spoil material to its approximate original contour.

c. Compliance with Applicable Water Quality Standards. The proposed discharge would not violate any applicable State Water Quality Standards. Use of sediment control strategies should lessen the effect of increased turbidity during the event of high flows.

d. Compliance with Applicable Toxic Effluent Standards or Prohibition under Section 307 of the Clean Water Act. The proposed discharge would not violate the Toxic Effluent Standards (40 CFR 129) developed pursuant to Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act of 1973 (as amended). Discharges at the proposed site would not affect the "critical habitat" of an endangered or threatened species. Neither the power plant nor the makeup water pipeline will effect the continued existence of an endangered species. The USFWS is currently evaluating the effect of the mining activity.

f. Findings of Significant Degradation of Waters of the United States. The project would not cause significant degradation of waters of the United States. Impacts of mining on wildlife resources would be potentially significant. The proposed discharge would not result in significant adverse impacts on human health or welfare, municipal water supplies or recreation, aesthetic and economic values.

g. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem.

1) Sedimentation ponds would be constructed to reduce sedimentation of downstream surface-water bodies.

2) Denuded areas would be revegetated to reduce erosion.

3) The SCS floodwater retarding structures proposed for removal during mining would be replaced during reclamation.

4) Some sedimentation ponds would be incorporated into the postmining land use scheme to provide aquatic habitat and stock watering ponds.

5) Major portions of the stream channel of Turkey, Walnut and Prairie creeks and associated riparian habitat would not be disturbed.

h. On the Basis of the Guidelines, the Proposed Disposal Site for Discharge of Fill Matieral is: Specified as complying with the requirements of these guidelines with the inclusion of practicable mitigative measures to minimize adverse impacts to the affected aquatic ecosystem.

Appendix B

Preliminary Draft NPDES Permits

Permit No. TX0090981
Application No. TX0090981

TDWR Permit No. 02588

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Houston Lighting and Power Company
P.O. Box 1700
Houston, Texas 77001

is authorized to discharge from a facility located at

Malakoff, Henderson County, Texas

to receiving waters named

Trinity River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

Myron O. Knudson, P.E.
Director, Water Management Division (6W)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 001, intermittent flow, Lignite pile runoff, commingled with cooling tower blowdown and low volume wastes****. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	N/A	(Report)	(0.720)	1/day	Estimate
Total Suspended Solids	N/A	N/A	30 mg/l	100 mg/l	1/week	Grab
Oil and Grease	N/A	N/A	15 mg/l	20 mg/l	1/week	Grab
Free Available Chlorine	N/A	N/A	0.2 mg/l	0.5 mg/l	1/week**	Grab
Temperature degrees*	N/A	N/A	N/A	33.9C(93F)***	1/day**	In Situ
Selenium	N/A	N/A	N/A	0.10***	1/month	Grab

* Pollutants applicable only to cooling tower blowdown.
** Sample taken only when discharging cooling tower blowdown.
*** Instantaneous maximum.
**** See Part III, Paragraph 5.

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The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At Outfall 001, at the discharge of the storm water treatment system clarifier prior to mixing with any other waste stream.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 002, intermittent flow, material storage* runoff and washdown water

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	N/A	(Report)	N/A	1/day	Estimate
Total Suspended Solids	N/A	N/A	50 mg/l	N/A	1/week***	Grab
Selenium	N/A	N/A	N/A	0.1 mg/l**	1/week***	Grab

* See Part III, Paragraphs 6,7, and 8.
** Instantaneous maximum.
*** When discharge occurs.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week*** by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At Outfall 002, at the discharge of the runoff sedimentation pond(s) prior to mixing with any other waste stream.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 003, intermittent flow, (floor drainage treatment system) low volume wastewater*

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	(Report)	(0.55)	1/day	Estimate
Total Suspended Solids	N/A	N/A	30 mg/1	100 mg/1	1/week	Grab
Oil and Grease	N/A	N/A	15 mg/1	20 mg/1	1/week	Grab

* See Part III, Paragraph 5.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
At Outfall 003, where the low volume wastewaters are discharged from floor drainage treatment system prior to mixing with any other waste stream.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 004, intermittent flow, demineralizer regenerant and other low volume waste streams*. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	(Report)	(0.173)	1/day	Estimate
Total Suspended Solids	N/A	N/A	30 mg/l	100 mg/l	1/week	Grab
Oil and Grease	N/A	N/A	15 mg/l	20 mg/l	1/week	Grab

* See Part III, Paragraph 5.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At Outfall 004, where treated low volume wastewaters are discharged from the chemical waste treatment system prior to mixing with any other waste stream.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 005, intermittent flow, metal cleaning waste* commingled with low volume wastes* and ash transport water*.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	(Report)	(0.216)	1/day	Estimate
Total Suspended Solids	N/A	N/A	30 mg/l	100 mg/l	1/week	Grab
Oil and Grease	N/A	N/A	15 mg/l	20 mg/l	1/week	Grab
Iron, Total	N/A	N/A	1.0 mg/l	1.0 mg/l	1/week	Grab
Copper, Total	N/A	N/A	1.0 mg/l	1.0 mg/l	1/week	Grab
Selenium*	N/A	N/A	0.05 mg/l	0.10 mg/l	1/week**	Grab

* See Part III, Paragraphs 4, 5 and 3

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At Outfall 005, at the discharge of the metal cleaning waste treatment system prior to mixing with any other waste stream.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from outfall(s) serial number(s) 006, sanitary waste treatment System

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	(0.07)	(0.144)	1/day	Estimate
Total Suspended Solids	5.3(11.7)	N/A	20 mg/1	45 mg/1	1/week	Grab
Biochemical Oxygen Demand (5-day)	5.3(11.7)	N/A	20 mg/1	45 mg/1	1/week	Grab

The effluent shall contain a chlorine residual of at least 1.0 mg/1 after a detention time of at least 20 minutes (based on peak flow) and shall be monitored daily by grab sample.

An equivalent method of disinfection may be substituted with prior approval of the permitting authority.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At Outfall 006, at the discharge of the sanitary waste treatment system and prior to mixing with any other waste stream.

SECTION B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

None.

PART II
STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

The Clean Water Act provides that any person who violates a permit condition implementing sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

5. Toxic Pollutants

Notwithstanding paragraph A-4, above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified.

The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" Section B, Paragraph B-3 and "Upsets" Section B, Paragraph B-4, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs c and d of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D, Paragraph D-6 (24-hour notice).

d. **Prohibition of bypass.**

(1) Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under paragraph c of this section.

(2) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph d(1) of this section.

4. Upset Conditions

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph c of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Section D, Paragraph D-6.

(4) The permittee complied with any remedial measures required under Section A, Paragraph A-3.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment of control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10% from true discharge rates throughout the range of expected discharge volumes. Guidance in selection, installation, calibration and operation of acceptable flow measurement devices can be obtained from the following references:

a. "A Guide to Methods and Standards for the Measurement of Water Flow", U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 421, May 1975, 97 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by SD catalog No. C13.10:421).

b. "Water Measurement Manual", U. S. Department of Interior, Bureau of Reclamation, Second Edition, Revised Reprint, 1974, 327 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by Catalog No. I27.19/2:W29/2, Stock No. S/N 24003-0027).

c. "Flow Measurement in Open Channels and Closed Conduits, U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 484, October 1977, 982 pp. (Available in paper copy or microfiche from National Technical Information Service (NTIS), Springfield, VA 22151. Order by NTIS No. PB-273 535/5ST).

d. "NPDES Compliance Sampling Manual", U. S. Environmental Protection Agency, Office of Water Enforcement, Publication MCD-51, 1977, 140 pp. (Available from the General Services Administration (8FFS), Centralized Mailing Lists Services, Building 41, Denver Federal Center, Denver, CO 80225.)

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

5. Reporting of Monitoring Results

Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (EPA No. 3320-1). Monitoring results obtained during the previous months shall be summarized for each month and reported on a DMR form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due ________________. Duplicate copies of DMR's signed and certified as required by Section D, Paragraph D-11, and all other reports required by Section D, Reporting Requirements, shall be submitted to the Regional Administrator

Myron O. Knudson, P.E.
Director, Water Management Division (6W)
U.S. Environmental Protection Agency
Region VI
First International Building
Dallas, Texas 75270

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless other wise specified by the Director in the permit.

8. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Section C, Paragraph C-5 (Monitoring).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

The following shall be included as information which must be reported within 24 hours:

a. Any unanticipated bypass which exceeds any effluent limitation in the permit.

b. Any upset which exceeds any effluent limitation in the permit.

c. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in Part III of the permit to be reported within 24 hours.

7. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under Section D, Paragraphs D-1, D-4, D-5, and D-6 at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D-6.

8. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the "notification levels" described in 40 CFR 122.61.

b. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

9. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

11. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice-president;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above.

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

12. Availability of Reports

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

13. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

PART III
OTHER CONDITIONS

For the purpose of Part I of this permit, the following definitions shall apply in lieu of those under "Part I, Section C, 'Monitoring and Reporting'", where limitations are expressed in concentration:

a. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.
b. The "daily maximum" concentration means the daily determination of concentration for any calendar day.

There shall be no discharge of polychlorinated biphenyl transformer fluid.

The term "free available chlorine" shall mean the value obtained using the amperometric titration method for free available chlorine described in "Standard Methods for the Examination of Water and Wastewater", page 112 (13th edition).

Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day and not more than one unit in any plant may discharge free available or total residual chlorine at any one time unless the permittee can demonstrate to the permitting Agency that the units in a particular location cannot operate at or below the limitations specified in this permit.

The term "ash transport water" shall mean water used in the transport of either fly ash or bottom ash.

The term "metal cleaning wastes" shall mean any cleaning compounds, rinse waters, or other waterborne residues derived from cleaning any metal process equipment including, but not limited to, boiler tube cleaning, boiler fireside cleaning and air preheater cleaning.

The term "low-volume waste sources" means, wastewaters from, but not limited to: wet scrubber air pollution control systems, ion exchange water treatment system, water treatment, evaporator and boiler blowdown, laboratory and sampling streams, floor drainage, cooling tower basin cleaning wastes and blowdown from recirculating house service water systems.

The term "area runoff" means discharges resulting from material storage runoff and construction runoff.

The term "material storage runoff" means the rainfall runoff from or through any coal, ash or other material storage pile.

Any untreated overflow from facilities designed, constructed and operated to treat the volume of "material storage runoff" and "construction runoff" which is associated with a 10 year, 24-hour rainfall event shall not be subject to the limitations specified in Part 1, area runoff, of this permit.

The term "10 year, 24-hour rainfall event" shall mean a rainfall event with a probable recurrence interval of once in ten years as defined by the National Weather Service in Technical Paper No. 40, "Rainfall Frequency Atlas of the United States", May 1961, and subsequent amendments, or equivalent regional or state rainfall probability information developed therefrom.

Permit No. TX0092134
Application No. TX0092134

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

The North American Coal Corporation
13140 Coit Road, Suite 400
Dallas, Texas 75240

is authorized to discharge from a facility located

The Trinity Mine
Malakoff & Coit Roads
Henderson County, Texas

to receiving waters named Trinity River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

Myron O. Knudson, P.E.
Director, Water Management Division (6W)

PART I
REQUIREMENTS FOR NPDES PERMITS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - Outfall 001

During the period beginning the effective date and lasting through the expiration date

the permittee is authorized to discharge from Outfall(s) serial number(s) 001 through 012, sedimentation pond discharge.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	kg/day(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	(*)	(*)
Total Suspended Solids	N/A	N/A	35.0 mg/l	70.0 mg/l
Iron, total	N/A	N/A	3.0 mg/l	6.0 mg/l
Manganese, total	N/A	N/A	2.0 mg/l	4.0 mg/l

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	1/day**	Estimate***
Total Suspended Solids	1/day**	Grab
Iron, Total	1/day**	Grab
Manganese, total	1/day**	Grab

* Report
** During periods of discharge
*** See Part III, Paragraph B.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/day** by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At the flow monitoring device prior to discharge from the sedimentation pond.

PART I
REQUIREMENTS FOR NPDES PERMITS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - Outfall 101 -

During the period beginning the effective date and lasting through the expiration date

the permittee is authorized to discharge from Outfall(s) serial number(s) 101, treated domestic wastewater (outfall 101 discharges to the sedimentation pond upstream of Outfall 001).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	kg/day(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	(*)	(*)
Biochemical Oxygen Demand (BOD_5)	0.5(1)	0.9(2)	N/A	N/A
Total Suspended Solids	0.5(1)	0.9(2)	N/A	N/A

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	1/week	Grab
Biochemical Oxygen Demand (BOD_5)	1/week	Grab
Total Suspended Solids	1/week	Grab

* Report
** See Part III, Paragraph I

The pH shall not be less than N/A standard units nor greater than N/A standard units and shall be monitored N/A.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Domestic Wastewater treatment plant effluent downstream of the final treatment unit.

SECTION B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

None

PART II
STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

The Clean Water Act provides that any person who violates a permit condition implementing sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

5. Toxic Pollutants

Notwithstanding paragraph A-4, above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified.

The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" Section B, Paragraph B-3 and "Upsets" Section B, Paragraph B-4, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs c and d of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D, Paragraph D-6 (24-hour notice).

d. Prohibition of bypass.

(1) Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under paragraph c of this section.

(2) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph d(1) of this section.

4. Upset Conditions

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph c of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Section D, Paragraph D-6.

(4) The permittee complied with any remedial measures required under Section A, Paragraph A-3.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10% from true discharge rates throughout the range of expected discharge volumes. Guidance in selection, installation, calibration and operation of acceptable flow measurement devices can be obtained from the following references:

a. "A Guide to Methods and Standards for the Measurement of Water Flow", U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 421, May 1975, 97 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by SD catalog No. C13.10:421).

b. "Water Measurement Manual", U. S. Department of Interior, Bureau of Reclamation, Second Edition, Revised Reprint, 1974, 327 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by Catalog No. I27.19/2:W29/2, Stock No. S/N 24003-0027).

c. "Flow Measurement in Open Channels and Closed Conduits, U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 484, October 1977, 982 pp. (Available in paper copy or microfiche from National Technical Information Service (NTIS), Springfield, VA 22151. Order by NTIS No. PB-273 535/5ST).

d. "NPDES Compliance Sampling Manual", U. S. Environmental Protection Agency, Office of Water Enforcement, Publication MCD-51, 1977, 140 pp. (Available from the General Services Administration [8FFS], Centralized Mailing Lists Services, Building 41, Denver Federal Center, Denver, CO 80225).

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

5. Reporting of Monitoring Results

Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (EPA No. 3320-1). Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a DMR form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due ________________. Duplicate copies of DMR's signed and certified as required by Section D, Paragraph D-11, and all other reports required by Section D, Reporting Requirements, shall be submitted to the Regional Administrator and the State at the following addresses:

Myron O. Knudson, P.E., Director
Water Management Division (6W)
U.S. Environmental Protection Agency
Region VI
First International Building
1201 Elm Street
Dallas, Texas 75270

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless other wise specified by the Director in the permit.

8. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Section C, Paragraph C-5 (Monitoring).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

The following shall be included as information which must be reported within 24 hours:

a. Any unanticipated bypass which exceeds any effluent limitation in the permit.

b. Any upset which exceeds any effluent limitation in the permit.

c. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in Part III of the permit to be reported within 24 hours.

7. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under Section D, Paragraphs D-1, D-4, D-5, and D-6 at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D-6.

8. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the "notification levels" described in 40 CFR 122.61.

b. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

9. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

11. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice-president;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above.

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

12. Availability of Reports

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

13. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

PART III
OTHER CONDITIONS

A. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.

The "daily maximum" concentration means the daily determination of concentration for any calendar day.

B. Methods of flow estimating shall be by the "California Pipe Method" as described in section 7.4.2.2. of the Handbook for Monitoring Industrial Wastewater, August 1973, U.S. Environmental Protection Agency, Technology Transfer.

C. Effluent Limitations for Precipitation events

(a) Any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent Limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/l	N/A
pH	Within the range of 6.0 to 9.0 at all times	

(b) Any discharge or increase in volume of a discharge caused by precipitation within any 24-hour period greater than the 10-year, 24-hour event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
pH	Within the range of 6.0 to 9.0 at all times	

(c) The operator shall have the burden of proof that the discharge or increase in discharge was caused by the applicable precipitation event described in subsections (a) and (b).

D. 10-year 24-hour Precipitation Event

The term "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable recurrence interval of once in ten years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

E. Effluent Limitations for Reclamation Areas

The following standards apply to discharges from reclamation areas until SMCRA bond release

Effluent Limitations

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/1	N/A
pH	Within the range 6.0 to 9.0 at all times	

F. Determination of Settleable Solids

The following procedure shall be used to determine settleable solids:

Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating materials occurs, do not include the floating material in the reading.

The method detection limit for measuring settleable solids shall be 0.4 ml/1.

G. Initial Discharge Locations

Outfall No.	Pond/Purpose Identification	Receiving Waterway and Subsequent Flow	Proposed Start Date
001	Facilities sediment and sewage treatment	Unnamed tributary to Walnut Creek, Walnut Creek, Cedar Creek, then Trinity River	1985
002	Disturbed mining area, dragline erection	Same description as 001	1985
003	Disturbed mining area	Same description as 001	1985
004	Disturbed mining area	Same description as 001	1987

Outfall No.	Pond/Purpose Identification	Receiving Waterway and Subsequent Flow	Proposed Start Date
005	Disturbed mining area	Same description as 001	1991
006	Disturbed mining area	To Turkey Creek north of levee, Walnut Creek, Cedar Creek, then Trinity River	1986
007	Disturbed mining area	Same description as 006	1989
008	Disturbed mining area	Same description as 006	1991
009	Disturbed mining area	Same description as 006	1989
010	Disturbed mining	Same description as 006	1988
011	Disturbed mining area	To Turkey Creek, south of levee, the cutoff then to Trinity River	1988
012	Disturbed mining area	Same description as 011	1989

H. Locations may be revised by the permittee if it becomes necessary to eliminate or establish new holding ponds. For any revision the permittee shall submit appropriate maps redesignating the holding pond location.

Any revised pond or outfall location should be consistent with and fall within the mining area boundary as defined in the applicant's State Mining Plan.

Any revised pond or outfall location shall be limited to discharging to the same receiving body of water.

I. The effluent shall be disinfected equivalent to chlorination to achieve a chlorine residual of at least 1.0 mg/l after a dentention time of at least 20 minutes (based on peak flow) and shall be monitored once per week by grab sample. An equivalent method of disinfection may be subsituted with prior approval of the permitting authority.

Appendix C
Section 7 Consultation

C-1-

IN REPLY REFER TO:

SE

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

March 9, 1982

RECEIVED
MAR 12 1982
6 ES

Mr. Clinton B. Spotts
Regional EIS Coordinator
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

This is in response to your letter dated February 18, 1982, concerning the Malakoff Electric Generating Station, near Malakoff, Henderson County, Texas. As provided by Section 7(c)(1) of the Endangered Species Act, the Fish and Wildlife Service furnishes, upon request, a list of Federally listed and proposed species that may be affected by Federal construction actions. The attached list contains those species that potentially may be affected by your granting a National Pollutant Discharge Elimination System permit for the generating station that could impact air and water quality and fish and wildlife. Please request separate lists for the lignite mine and issuance of a Permit for Significant Deterioration of air quality.

The U.S. Fish and Wildlife Service tentatively considers construction projects to be any major action which is authorized, funded, or carried out by a Federal agency, which significantly affects the quality of the human environment, and which is designed primarily to result in the building or erection of man-made structures. Normally these projects require an environmental impact statement.

Upon receipt of the Fish and Wildlife Service's species list, the Federal agency authorizing, funding, or carrying out the Federal action will conduct a biological assessment to determine whether or not the Federal action will affect listed or proposed species.

The biological assessment shall be completed within 180 days after receipt of the species list, unless it is mutually agreed to extend this period. If the assessment is not initiated within 90 days after receipt of the species list, I suggest its accuracy be verified before conducting the assessment.

The biological assessment should include as a minimum:

1) onsite inspection of the area affected by the proposed activity or program, including a detailed survey of the

area to determine if species are present and whether suitable habitat exists for either expanding the existing population or potential reintroductions of populations;

2) interviews with recognized experts on the species at issue, including personnel of the Fish and Wildlife Service, of State conservation departments, of universities, and others who may have data not yet found in scientific literature;

3) review literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements;

4) review and analysis of the effects of the proposed action on individuals and populations, including consideration of both direct and indirect effects of the proposal on the species and its habitat;

5) analysis of alternative actions that may promote conservation of the species;

6) other relevant information;

7) written report documenting the assessment results.

If the Federal permitting action is not a construction project, there is no need to prepare a biological assessment. However, it remains incumbent upon the Federal agency to assess whether its action may affect endangered and threatened species.

If the Federal agency determines that its proposed action may affect listed species, the Federal agency shall initiate the formal Section 7 consultation process by writing to the Regional Director, Region 2, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103. If no effect is evident, there is no need for further consultation. However, I would appreciate the opportunity to review your biological assessment.

In addition, the Act (Sec. 7(a)(3)) now requires Federal agencies to confer with the Service on any agency action likely to either jeopardize the continued existence of any species proposed for listing as endangered or threatened or adversely modify proposed critical habitat. The purpose of this requirement is to identify and to resolve at the early planning stage of an action all potential conflicts between the action and the respective species and critical habitat. The informal Section 7 consultation process can accomplish this requirement.

If you have need of further assistance, please call the Office of Endangered Species at (505) 766-3972 or FTS 474-3972.

Sincerely yours,

Assistant Regional Director

Attachment

cc: Austin Area Manager, Austin, Texas
Field Supervisor, Ecological Services, Fort Worth, Texas

C-4-

Malakoff Electric Generating Station,
NPDES Permit Application
Malakoff, Henderson County, Texas

LISTED SPECIES

American alligator (Alligator mississippiensis) - occupies aquatic habitats and habitats closely associated with aquatic habitats.

Whooping crane (Grus americana) - migrates through central Texas during the fall and spring.

Red-cockaded woodpecker (Picoides borealis) - inhabitats mature pine forests in east Texas.

Attwater's prairie chicken (Typanuchus cupido attwateri) - occurs on native tall grass prairies of the coastal region.

Bald eagle (Haliaeetus leucocephalus) - overwinters in Texas on larger bodies of waters, such as reservoirs, rivers, and bayous. Fish and carrion constitute the principal food items.

Houston toad (Bufo houstonensis) - occurs in sandy areas with ponds during the spring rainy season. Critical habitat for the Houston toad has been designated for parts of Bastrop and Burleson Counties.

CRITICAL HABITAT

None.

PROPOSED SPECIES

Navasota ladies tresses (Spiranthes parksii) - occurs along the Navasota River in Brazos County.

Norris

C-6-

IN REPLY REFER TO:

SE

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

June 2, 1982

RECEIVED
JUN 7 1982
6 ES

Mr. Clinton B. Spotts
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

This is in response to your undated letter received May 20, 1982, concerning the Trinity Mine and Upper River Municipal Water Authority. As provided by Section 7 (c)(1) of the Endangered Species Act, the Fish and Wildlife Service furnishes, upon request, a list of federally listed and proposed species that may be affected by Federal construction actions. The Regional Office of Endangered Species has used the information in your request to narrow the list of listed and proposed species which occur in Henderson and Anderson Counties, Texas, to those that potentially may be affected by your proposed action (see attachment).

The U.S. Fish and Wildlife Service tentatively considers construction projects to be any major action which is authorized, funded, or carried out by a Federal agency, which significantly affects the quality of the human environment, and which is designed primarily to result in the building or erection of manmade structures. Normally these projects require an environmental impact statement.

Upon receipt of the Fish and Wildlife Service's species list, the Federal agency authorizing, funding, or carrying out the Federal action will conduct a biological assessment to determine whether or not the Federal action will affect listed or proposed species.

The biological assessment shall be completed within 180 days after receipt of the species list, unless it is mutually agreed to extend this period. If the assessment is not initiated within 90 days after receipt of the species list, I suggest its accuracy be verified before conducting the assessment.

The biological assessment should include as a minimum:

1) onsite inspection of the area affected by the proposed activity or program, including a detailed survey of the

C-7-

area to determine if species are present and whether suitable habitat exists for either expanding the existing population or potential reintroductions of populations;

2) interviews with recognized experts on the species at issue, including personnel of the Fish and Wildlife Service, of State conservation departments, of universities, and others who may have data not yet found in scientific literature;

3) review literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements;

4) review and analysis of the effects of the proposed action on individuals and populations, including consideration of both direct and indirect effects of the proposal on the species and its habitat;

5) analysis of alternative actions that may promote conservation of the species;

6) other relevant information;

7) written report documenting the assessment results.

If the Federal permitting action is not a construction project, there is no need to prepare a biological assessment. However, it remains incumbent upon the Federal agency to assess whether its action may affect endangered and threatened species.

If the Federal agency determines that its proposed action may affect listed species, the Federal agency shall initiate the formal Section 7 consultation process by writing to the Regional Director, Region 2, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103. If no effect is evident, there is no need for further consultation. However, I would appreciate the opportunity to review your biological assessment.

In addition, the Act (Sec. 7(a)(3)) now requires Federal agencies to confer with the Service on any agency action likely to either jeopardize the continued existence of any species proposed for listing as endangered or threatened or adversely modify proposed critical habitat. The purpose of this requirement is to identify and to resolve at the early planning stage of an action all potential conflicts between the action and the respective species and critical habitat. The informal Section 7 consultation process can accomplish this requirement.

If you have need of further assistance, please call the Office of Endangered Species at (505) 766-3972 or FTS 474-3972.

Sincerely yours,

Jerry L. Stegman

Acting Regional Director

Attachment

cc: Area Manager, Austin Area Office, Austin, TX
Field Supervisor, Ecological Services Field Office, Fort Worth, Texas

Trinity Mine and Upper Neches
River Municipal Water Authority

LISTED SPECIES

The bald eagle (Haliaeetus leucocephalus) - nests and overwinters in east Texas.

The whooping crane (Grus americana) - migrates through central Texas and may use agricultural lands, river bottoms, and other areas for feeding, resting, and roosting.

The red-cockaded woodpecker (Picoides borealis) - occurs in mature pine forests in east Texas.

The American alligator (Alligator mississippiensis) - may be found in association with any aquatic habitat in east Texas.

The Houston toad (Bufo houstonensis) - may occur in sandy soils in Henderson County typical of its habitat in Bastrop County.

PROPOSED SPECIES

None.

CRITICAL HABITAT

None.

C-10-

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

IN REPLY REFER TO:
SE

October 25, 1982

OCT 29 1982
6 ES

Mr. Clinton B. Spotts
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

This is in response to your letter of September 29, 1982, in which you state that construction and operation of the Malakoff Electric Generating Station, Henderson County, Texas, will not affect any federally listed threatened or endangered species. The Regional Office of Endangered Species has reviewed the biological assessment that accompanied your letter, and in accordance with their recommendation, I agree with your conclusion of "no effect."

Thank you for your continued cooperation toward conservation of endangered species.

Sincerely yours,

Regional Director

cc: Field Supervisor, Ecological Services, Fort Worth, Texas, w/incoming

C-11-

IN REPLY REFER TO:

File- Licensing-

RECEIVED

NOV 10 1982

6ES

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
9A33 Fritz Lanham Building
819 Taylor Street
Fort Worth, Texas 76102

November 9, 1982

Mr. Clinton B. Spotts
Chief, Federal Activities Branch (6ES-F)
U.S. Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

We are in receipt of your November 2, 1982, letter which transmitted a copy of the biological assessment for the Malakoff Electric Generating Station makeup water intake structure and pipeline corridor in Henderson and Anderson Counties, Texas. Your biological assessment indicates that there will be no effect to any Federally listed threatened or endangered species as a result of the construction and operation of these facilities.

We have reviewed the biological assessment and concur with your conclusion of "no effect". The opportunity to review this document is appreciated.

Sincerely,

Jerome L. Johnson

Jerome L. Johnson
Field Supervisor

cc: Regional Director, Fish and Wildlife Service,
Albuquerque, NM (SE)

RECEIVED
NOV 17 1982
ENVIRONMENTAL PROTECTION DEPT
PLANNING & ASSESSMENT

C-12-

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

January 6, 1983

Mr. Jerome Johnson
Field Supervisor
U. S. Fish & Wildlife Service
Ecological Services
9A33 Fritz Lanham Bldg
819 Taylor St.
Fort Worth, Texas 76120

Dear Mr. Johnson:

During May, 1982, EPA requested an endangered species listing for the Trinity Mine from the Fish and Wildlife Service. In a letter dated June 2, 1982, the Albuquerque office responded with a list that included the bald eagle, whooping crane, red-cockaded woodpecker, american alligator, and the houston toad.

We completed the biological assessment on November 17, 1982, and are forwarding it with this letter. Based on our analysis of the biological assessment, we have determined there will be "no effect" on the whooping crane, red-cockaded woodpecker, or the houston toad. However, mining activity will destroy potential habitat for the bald eagle and the american alligator. It is also possible that individual alligators may be displaced or destroyed. Therefore, we have determined that the project "may effect" the bald eagle and the american alligator. As a result of these findings, we are requesting formal consultation with your agency.

Sincerely yours,

Clinton B. Spotts

Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

cc: Carl Venzke
Steve Davies
Ed Wendt
Charles Jasper ✓
Alan Brackney (w/enclosure)

Appendix D
USCE Wetlands Determinations

U. S. ARMY CORPS OF ENGINEERS
WETLAND DETERMINATION

Trinity Mine and Malakoff Power Generating Station

Proposed by North American Coal Company and
Houston Lighting and Power Company

INTRODUCTION

The U.S. Army Corps of Engineers (COE) regulates the discharge of dredged and fill material into waters of the United States including adjacent wetlands under Section 404 of the Clean Water Act (CWA). The Regional Administrator of the United States Environmental Protection Agency (EPA) has ultimate authority to determine the reach of waters of the United States as described in the CWA. In accordance with the Memorandum of Understanding (MOU) with EPA concerning geographical jurisdiction of the Section 404 program, the COE has been requested by EPA to establish the boundaries of waters of the United States which do not involve significant issues or technical difficulties where EPA has declared a special interest.

The Trinity Mine and Malakoff Power Generating Station along the Trinity River, Cedar Creek, and their tributaries in Henderson and Anderson Counties, Texas is proposed by the North American Coal Company (NACCO) and Houston Lighting and Power Company (HL&P). Since they do not involve any such special interest, the Regional Administrator of EPA has requested that COE, as a cooperating agency, determine the jurisdictional limit under Section 404 for the Trinity Mine and Malakoff Power Generating Station. This determination is being prepared in support of the COE permit program and its purpose is to detail the extent of the waters of the United States including adjacent wetlands in the proposed project area.

Since COE also regulates any work in or affecting navigable waters of the United States under Section 10 of the River and Harbor Act of 1899, the extent of the navigable waters of the United States in the mine area is also included.

METHODS

Field investigations of the project area were conducted on 14-16 June 1982 by representatives of COE, NACCO, and Environmental Consultants Inc. In addition, the area of the Power Station and associated structures were examined on 14 April 1982 by personnel of COE and HL&P.

Spot checks on transects were examined at 28 locations. In addition, site descriptions provided by Faust and Mahler (1982) were referenced. These sites were selected on the basis of accessibility, drainage characteristics, topography, and representative features. The locations of 24 wetland and non-wetland sites are shown on the accompanying maps and described in Appendix A.

Malakoff Power Generating Station

Transects and spot checks also encompassed nonwetland areas to discern differences in key characteristics and to estimate lines of demarcation between wetland and nonwetland areas. The investigation at each site included the identification of vegetative communities, examination of soils and an observation of positive hydrologic indicators (ie. flood debris, silt deposition, standing water, high ground water etc).

Wetlands were identified where positive hydrologic indicators were found in conjunction with evidence of saturated soils and vegetation adapted to, or tolerant of these conditions. Research publications or literature summaries which were referenced to determine tolerances of species mentioned in the text include McKnight et al (1980), Bedinger (1979), Teskey and Hinckley (1977), and Huffman (1980). Due to the inaccessability of some of the area, color infrared aerial photographs were used to map wetlands which could not be visited. This was done by identifying key color and texture characteristics of known wetland and nonwetland areas on the infrared photograph and mapping areas showing those wetland characteristics.

In addition to the wetlands identified in this report, COE area of jurisidiction under Section 404 includes each stream below its ordinary high water mark, stream oxbows, and impoundments. The area of jurisdiction under Section 10 includes the Trinity River.

SUMMARY OF FIELD OBSERVATIONS

The proposed mining area is composed of uplands with sandy loam and loam soils; small drainages and streams with loamy soils in the floodplains particularly Nahatchie loam; and the Cedar Creek and Trinity River floodplain with Kaufman, Gladewater and Trinity clays. Under natural conditions these heavy black clays are frequently flooded and remain saturated for extended periods. However, the construction of the levee system has altered the water regime of the area extensively and protected much of the floodplain from flooding. Impoundments occur at some points along the upland side of the levee and emergent or shrub wetlands now occur in old shallow creek channels, drainages, and borrow ditches. These areas are variously vegetated by sedge, cattail, rush, smartweed, water primrose, black willow, green ash, swamp privet, and buttonbush. Small isolated emergent and shrub wetlands also occur upstream of the Trinity River floodplain along several small streams. Much of the Cedar Creek and Trinity River floodplain within the levees have been cleared and converted to improved pasture lands. Where levee protection has not been provided, the floodplain forest shows low species diversity and extreme signs of stress from flooding. Selective logging may account for a portion of the low diversity found there. This open canopy forest is dominated by cedar elm with associates of overcup oak, green ash, boxelder, honey locust and hawthorn.

The vegetation adjacent to the small streams on loamy soils at nonwetland sites is improved pasture or forest composed of water oak, pecan, black walnut, red mulberry, sugarberry, cedar elm, American elm, and black hickory with an understory of sumac, soapberry, yaupon, greenbriar, poison ivy, and grape. The upland sandy and loamy soils support forest dominated by post oak, blackjack oak, cedar elm, and eastern red cedar. This forest is interspersed with pasture land used for cattle production.

Malakoff Power Generating Station

CONCLUSION

As transition areas between the aquatic and terrestrial zones, wetlands exist within a broad range of hydric conditions. They are defined, for purposes of our regulatory program, as those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalance of vegetation typically adapted to life in saturated soil condition. The prevalent vegetation which occurs in wetlands designated in this report has been shown by various studies to be tolerant of flooding and saturated soils, and in some cases the species are specifically adapted to such conditions. It is significant that species known to have little tolerance to flooding or saturated soils did not occur within the wetlands. The total wetland acreage in the proposed mine area is 3,540 acres. This includes 2,776 acres adjacent to Cedar Creek and the Trinity River and wihin the area of jurisdiction under 404; and 784 acres within the area of jurisdiction under Section 404 but upstream of the headwaters. An additional 253 acres of impoundments, all upstream of the headwaters, are also shown on the attached map. Wetlands which occur outside the mine area below the Cedar Creek Lake dam and which could potentially be impacted by powerline construction are also shown.

It is my determination that the areas designated on the attached maps and further described in Appendix A are wetlands consistent with the above definition and comprise a portion of the waters of the United States under our regulatory jurisdiction.

RECOMMENDED BY: David B. Barrows DATE: 23 July, 1982
DAVID B. BARROWS
Chief, Permits Section

REVIEWED BY: DATE: 23 July 82
L. M. HAWKINS, JR.
Chief, Office Operations Branch

APPROVED BY: Allie J. Majors DATE: 23 July 1982
ALLIE J. MAJORS, P.E.
Chief, Operations Division

LITERATURE CITED

Bedinger, M. S. 1979. Forests and Flooding with Special Reference to the White River and Quachita River Basins, Arkansas. U.S. Geological Survey Report No. 79-68, 24pp.

Huffman, R. T. 1980. The Relation of Flood Timing and Duration to Variation in Selected Bottomland Hardwood Communities of Southern Arkansas. U.S. Army Engineer Waterway Experiment Station, Vicksburg, Mississippi. Miscellaneous paper EL-80-4. 22pp.

McKnight, S. J., D. D. Hook, O. G. Langdon, and R. J. Johnson 1980. Flood Tolerance and Related Characteristics of Trees of the Bottomland Forest of the Southern United States. pp. 29-69. in Proceedings of a Workshop on Bottomland Hardwood Forest Wetlands of the Southeast Untied States, Lake Lanier Georgia. U.S. Department of Agriculture.

Teskey, R. O. and T. H. Hinckley 1977. Impact of Water Level Changes on Woody Riparian and Wetland Communities Volume II, Southern Forest Region. Department of the Interior, U.S. Fish and Wildlife Service, 46pp.

APPENDIX A

Site 1 - This area is adjacent to Cedar Creek and a tributary at the northeast corner of the mine site. The pasture north of this site is composed of upland grasses with scattered large cedar elm, American elm, and water oak. The soil is a dry Gladewater clay. Several isolated ponds and seeps occur in the pasture and are vegetated by willow oak, buttonbush, persimmon, soft rush, sedges, and spider lily. A drop of approximately five feet in elevation occurs adjacent to a tributary of Cedar Creek. This forested area supports green ash, overcup oak, and shumard oak in the overstory. The understory contains sugarberry, red mulberry, common persimmon, American elm, deciduous holly, and greenbriar. The lush herbaceous cover included sedges, with an occassional soft rush and swamp lily. The presence of several tree species with little tolerance for flooding excludes the area adjacent to the tributary as a wetland.

Site 2 - This transect was walked in a northwest to southeast direction from the uplands to Walnut Creek. The adjacent uplands are partially wooded. At the base of the hillside a strip of emergent wetland vegetation is composed of beak rush, sedges, nut sedges, and soft rush and is bordered by black willow. The majority of the floodplain is dry pasture with a narrow corridor of trees along the stream. This nonwetland corridor includes pecan, water oak, honeylocust, sugarberry, boxelder, sumac, cedar elm, green briar, and peppervine.

Site 3 - This nonwetland site is located on Walnut Creek at FM 90. In the downstream site, as described by Faust and Mahler (1982), the dominant tree species include American elm, cedar elm, hackberry, eastern cottonwood, green ash, boxelder, and a few individuals of pecan, water oak, sugarberry, eastern redbud, honeylocust, red mulberry, and black walnut. The understory includes wildgrape, Carolina rose, trumpet creeper, peppervine, and hawthorn. The upstream side supports a forest dominated by water oak with sugarberry, black hickory and yaupon in the understory. The soil is a dry Nahatchie loam.

Site 4 - This nonwetland site is located on Walnut Creek where FM 2636 crosses the stream. The area is primarily improved pasture. The stream edge includes a narrow corridor of trees along the stream. Most trees grow in the stream bed. The trees include sugarberry, cedar elm, pecan, American elm, red bud, boxelder, green ash, and sumac.

Site 5 - This wetland site was examined along a transect across the Cedar Creek - Walnut Creek floodplain to the south-southeast along the line of the proposed conveyor corridor. The soil is a wet Gladewater clay. The open canopy forest is composed of cedar elm with a few individuals of willow oak. Overcup oak and water hickory occur sporadically. The sparce understory includes sugarberry, cedar elm, hawthorn, honeylocust, deciduous holly, and greenbriar. Walnut Creek is a broad flowage in this area and is inhabited by dead trees and scattered swamp privet. According to Faust and Mahler (1982), shumard oak, eastern cottonwood, common persimmon, and pecan also occur in the southern edge of the wetland area. Also present there are poison ivy, yaupon, hawthorn, and wooly buckthorn. Some emergent macrophytes occur in the lower areas.

Site 6 - This wetland boundary site, on the north side of the levee on Cedar Creek, as described by Faust and Mahler (1982), included boxelder, green ash, hackberry, willow oak, cottonwood, a few yaupon, black walnut, red mulberry and overcup oak.

Site 7 - This wetland is located at the upstream end of Hall Lake. The emergent macrophytes described by Faust and Mahler (1982) included water primrose, arrowhead, spikerush, and mock bishop's-weed.

Site 8 - This site is an impoundment created by the levee and a plug in the outlet gate on Turkey Creek. The upper end of the area supports a lush growth of black willow.

Site 9 - This site is located on Turkey Creek where it crosses Highway 90. The woodlands adjacent to the stream at this location are fairly typical of non-wetland areas on the smaller tributaries in the mine area. The dry Nahatchie loam supports a forest dominated by water oak, and white ash. Common persimmon, slippery elm, and redbud are common understory species. Also in the understory are ratton vine, poison ivy and greenbriar. The upstream side of the floodplain is a pasture which supports Johnson grass, other planted grasses, and scattered small cedar elm along the stream channel.

Site 10 - These small emergent wetlands near an ongoing gravel mining operation are probably a result of high ground water and disrupted surface drainage at this site. The emergent vegetation in these wetlands includes cattail, sedges, beak rush, and soft rush.

Site 11 - This site is on a tributary of Turkey Creek. Water has been impounded in this area forming a wetland of standing dead trees and emergent macrophyte vegetation. A narrow band of smartweed, sedge, and beak rush exists along the edge of the impoundment. Landward of this band is a narrow corridor of overcup oak, willow oak, green ash, and buttonbush which intergrades into an upland composed of cedar elm and post oak. Upstream of the impoundment the channel swings to the northeast and is inclosed in a broad band of black willow.

Site 12 - This nonwetland site is within a bend of the Trinity River cutoff. The overstory is composed of shumard oak, cedar elm, honey locust, sugarberry, green ash, and red mulberry. The understory is primarily young trees of those species and scattered hawthorn. The soils are classified as a rarely flooded Kaufman clay. The soils are dry and few signs of flooding exist in the area.

Site 13 - This wetland site is a tributary to Turkey Creek. A small channel winds through an improved upland pasture into a forested area adjacent to the creek. In the pasture the channel supports smartweed, nut-sedge, cocklebur, and sedge. Where the channel enters the forest, overcup oak and green ash dominate the overstory and swamp privet is the predominant understory species.

Site 14 - Located along a back water north of Stephens Lake, this area was described by Faust and Mahler (1982). The dominant trees are cedar elm, bur oak, cottonwood, and green ash adjacent to the wetlands. Mature black willows and buttonbush occur in the wetlands along the backwater. The soil is a frequently flooded Gladewater clay.

Site 15 - This location on Priarie Creek is a wetland which supports extensive stands of cattail. These cattail stands are bordered by broad strips of sedges and scattered Bacharis.

Site 16 - At this wetland location, water pools in the lower portion of the channel. In the wooded upstream area, overcup oak, green ash, cedar elm, persimmon, and deciduous holly were prevelant. Many trees are growing in the water. The downstream area is open and vegetated primarily by sedges.

Site 17 - Wildcat Creek at this location is confined between two levees. Outside of the levees the soil is a dry Kaufman clay which supports an improved pasture. Between the levees the frequently flooded Kaufman clay soil supports a dense thicket of swamp privet (Faust and Mahler 1982).

Site 18 - A transect was walked into this forested area adjacent to the Trinity River. Evidence of flooding was present in the form of standing pools of water, piled flood debris, and dead and matted ground cover. The vegetation on the frequently flooded Trinity clay supports a forest community similar to that of Site 5. Stress from prolonged flooding was evident from the poor condition of the trees and the lack of reproduction. Cedar elm forms an open overstory canopy in the area in association with scattered overcup oak, sugarberry, green ash and honey locust. A small numer of osage orange also occur there.

Site 19 - This site adjacent to the Highway 287 bridge is much the same as Site 18. Black willow, green ash, boxelder, honeylocust, and cedar elm occupied the overstory and swamp privet and peppervine occur in the understory. This area was under several feet of water at the time it was visited.

Site(s) 20-23 - These locations are a few of the impoundments on small streams in the mine area. Several are soil conservation service flood and erosion control impoundments. All are located upstream of the headwaters.

APPENDIX B

SCIENTIFIC NAMES OF
PLANT IN TEXT

Bacharis	*Bacharis helmifolia*
Eastern cottonwood	*Populous deltoides*
Common persimmon	*Diospyros virginiana*
Overcup oak	*Quercus lyrata*
Willow oak	*Quercus phellos*
Water oak	*Quercus nigra*
Blackjack oak	*Quercus marylandica*
Post oak	*Quercus stellata*
Shumard oak	*Quercus shumardii*
Western soapberry	*Sapindus drummondii*
Honeylocust	*Gleditsia triacanthos*
Boxelder	*Acer negundo*
Green ash	*Fraxinus pennsylvanica*
White ash	*Fraxinus americana*
Water hickory	*Carya aquatica*
Black hickory	*Carya texana*
Pecan	*Carya illinoensis*
Black walnut	*Juglans nigra*
Red mulberry	*Morus rubra*
Deciduous holly	*Ilex decidua*
Yaupon	*Ilex vomitoria*
Sumac	*Rhus* sp.
Eastern red cedar	*Juniperus virginiana*
Wooly buckthorn	*Bumelia lanuginosa*
Rattan vine	*Berchemia scandens*
Greenbriar	*Smilax* sp.
Poison ivy	*Rhus radicans*
Grape	*Vitis* sp.
Peppervine	*Ampelopsis cordata*
Black willow	*Salix nigra*
Buttonbush	*Cephalanthus occidentalis*
Swamp privet	*Foresteria acuminata*
Carolina rose	*Rosa carolina*
Trumpet creeper	*Campsis radicans*
Eastern redbud	*Cercis canadensis*
American elm	*Ulmus americana*
Cedar elm	*Ulmus crassifolia*
Sugarberry	*Celtis laevigata*
Hawthorn	*Crataegus* sp.
Sedge	*Carex* sp.
Spider lily	*Hymenocallis sp.*
Soft rush	*Juncus effusus*
Smartweed	*Polygonum* sp.
Nut sedge	*Cyperis* sp.
Beak rush	*Rynchospora* sp.
Cattail	*Typha* sp.
Rush	*Juncus* sp.
Water Primrose	*Ludwigia* sp.
Spikerush	*Eleocharis* sp.
Mock bishops-weed	*Ptilimnium capillaceum*
Cocklebur	*Xanthium* sp.
Johnson grass	*Sorghum halepense*
Osage orange	*Maclura pomifera*

Appendix E
Cooperative Agreement between The North American Coal Corporation and the Trinity-Neches Soil and Water Conservation District

Trinity-Neches
Soil and Water Conservation District

Athens, Texas

Farmer-District Cooperative Agreement

This agreement is entered into by the Trinity-Neches Soil and Water Conservation District, referred to hereinafter as the "District", and

The North American Coal Corporation — 12800 Shaker Boulevard

Cleveland, Ohio 44120

referred to hereinafter as the "Farmer".

THE DISTRICT AGREES TO:

Assist in carrying out a conservation plan by furnishing to the Farmer such (1) information, (2) technical assistance and supervision, and (3) other assistance as it may have available at the time the work is to be done.

THE FARMER AGREES TO:

1. Use his land within its capabilities.
2. Treat his land in keeping with its needs.
3. Develop as rapidly as feasible a conservation plan for his entire farm.
4. Start applying one or more conservation practices in keeping with these objectives and the technical standards of the District.
5. Maintain all structures established in an effective condition, and to continue the use of all other conservation measures put into effect.
6. Use any materials or equipment made available to him by the District for the purpose and in the manner provided for it.

IT IS FURTHER AGREED THAT:

1. This agreement will become effective on the date of the last signature and may be ~~terminated or~~ modified by mutual agreement of parties hereto, or terminated by either party upon thirty (30) days' writt notic to th othe
2. The provisions of this agreement are understood by the Farmer and the District and neither shall be liable for damage to the other's property resulting from carrying out this agreement unless such damage is caused by negligence or misconduct.

WITNESS THE FOLLOWING SIGNATURES:

(Witness)

05-14-82
(Date)

Senior Vice President - Operations
(Owner)

NV

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TAK
CAN

TRINITY-NECHES SOIL AND WATER CONSERVATION DISTRICT

By R. J. Bass

Date 9-7-82

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